Analyzing New

Profit

Opportunities

A Guide to Making Business Projects Financially Successful

2nd Edition

by

K. Tobias Winther, Ph.D., MBA

FREE E-BOOK

- not for resale -

Agityne Corp.

Upton, Massachusetts, U.S.A.

Published by: Agityne Corporation, P.O. Box 690, Upton, MA 01568, U.S.A. Phone: +1-508-529-4135. www.agityne.com.

 This book is in part based on material from the book by K. T. Winther published in 2003, *Value and Profits in Business Strategy: a Seven-step Method for Improving the Bottom Line* (Agityne Corp., 290p, ISBN 0-9741727-3-1). This is the second edition of the book Analyzing New Profit Opportunities (ISBN 0-9741727-8-2).

Readers are welcome to send their comments by mail to the above address, or electronically to:

winther{at}agityne{dot}com

ISBN number: **0-9741727-2-3** 2nd edition
13-digit ISBN: **978-0-9741727-2-9**

Table of Contents

Acknowledgments

This book has benefited from the author's discussions with numerous people, all of whom are thanked—without those discussions the book would not be anything near what it is. The following organizations allowed the author to use their data for the case study on cars (Chapters 12 and 13): Crain Communications of New York, NY, Krause Publications of Iola, WI; Power Information Network/J. D. Power & Associates of Troy, MI; and Ward's Auto/Prism Business Media of Southfield, MI. Dr. C. Mazza provided the *smart fortwo* photo (Figure 36). Pleasant Hill Press edited the majority of the text for the first edition. The ISBN number bar code was generated using bookland.py from College Park Press of College Park, MD. Dr. Sam Savage of Stanford University and AnalyCorp made it possible to use the XLSim2 simulation software. GoldSim let the author try its simulation software for a case study.

Key Words

Business planning; car market; change management; cost; **decision making**; enabling mindset; enabling technology; innovation; market power; market size; marketing research; modeling; new product adoption; optimization; pricing; profit optimization; **profit**; radical innovation; risk; risk adjusted value; risk management; scenario planning; **strategic planning**; strategy; theory-structured learning; technology adoption, utilityscape; **value**; value chain; value creation; value driver; value net.

About the Book

The methods discussed in this book cover how to estimate market sizes, prices and their interdependency. The book is for people who develop new products or services and want to evaluate their market potential or find ways to improve upon them to make them more successful. Just as a tool in a shop helps you transform materials into a desired object, this book helps you transform data or market observations into a useful understanding needed to evaluate new areas of business and increase your chances of success. Many of the largest business successes depended on the insight of people, who at the time they made the right decisions, may not even have verbalized to themselves why these were the right decisions—it just seemed right to them. This book will help you get a more explicit understanding thereby easing the task of making better decisions and communicate to others why they are the right decisions. The final decisions may not differ from what those few insightful people would have come up with, but knowing why they are the right decisions helps reduce the risk.

Chapter 1
Introduction

Innovation is the name of the game in many business sectors. Firms launch an ongoing stream of new products and keep exploring new business models in order to achieve growth in sales, profits and company value. An extensive literature focuses on ways to develop innovative products, markets and business models.[1] While company executives hope their efforts will yield the desired results, the final verdict often lags until the market proves the innovators right or wrong.

Both among startups and established companies a significant percentage of the development projects lead to poor financial results. Mistakes can be costly, and sometimes leave even large companies in ruins.[2] Among the startups the odds are not good: 52 percent of all new businesses fail within the first four years.[3] But what can be done to *increase* the chance of success?

Making good decisions often depends on understanding the financial implications of the planned business activities. Although only one small step out of the entire business planning cycle (Figure 1), it is a critical step. Too often the financial projections rely on experience and gut feelings. Experience is great when the new endeavor bears close resemblance to previous undertakings. Gut feeling approaches sometimes work well; after all, some of the most noticeable marketplace "winners" started because of gut feelings about the market. The problem is all those times when it fails.

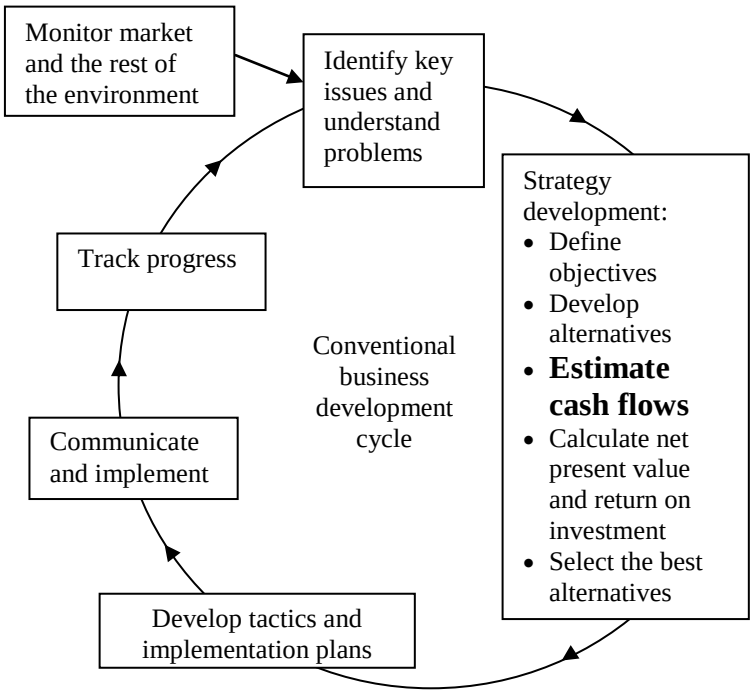


Figure 1. The business development cycle

A successful business tends to give customers the tools they need to create value for themselves. This book follows the same philosophy; it is a user's manual helping managers create value in their businesses. The future success of a business depends on its ability to create sustainable positive cash flows. If we have a tool relating management decisions to cash flows, we can evaluate different ideas before the fact and identify the most likely future winners. We can also use the understanding of the cash-generating mechanisms to design ideas that are likely to work or change existing plans so good technical ideas are more likely to lead to a business success. In turn, that will improve the whole process of defining a business strategy.

This book addresses the problems associated with the experience and gut feeling approaches by developing a toolbox for analyzing profit opportunities in a systematic and quantitative or semi-quantitative manner. Just as a civil engineer through quantitative analysis shows that a proposed bridge design can withstand certain wind speeds, a manager should be able to show investors that a proposed business can withstand a certain level of market turbulence.

Many of us wish we could predict the future the way the Oracle in Delphi claimed to do it—certainly it would be a good way to beat the market or always make the best decisions. One could argue that the future is to some degree bound by what exists today (infrastructure, humans, traditions), and predictable courses of development going forward from what exists. However, there will also always be an element of surprise, such as a really smart competitor, or a natural disaster. Therefore, those kinds of predictions may remain elusive phantoms.

What this book focuses on is different, namely questions of the kind, "If I (or somebody else) take a specific action, what might the likely range of outcomes be?" The action may be to introduce a new brand of shampoo. The result may be estimates of the financial impact it has for a specific company. We base these estimates on the assumption that historical data can tell us something useful about how humans may react in similar situations in the future.

A new product may have lots of features and there are many potential distribution channels, many different potential customers, many ways of marketing the product and many ways the competition may react. Therefore, estimating how the product will do in the market can seem like a very complex problem, and it is easy to drown in detailed information when we try to answer a few simple questions about market size and profitability. Looking at master pieces in art, science and engineering, precision is very important, but at the same time the problem has been simplified in a way so we do not get lost in irrelevant details. Actually too much detail can easily clutter the picture to a point that we can longer see what is important. We need to do the same here: simplify the clutter and create a *very precise* understanding of the essentials.

Good work is simple and very precise

This book is based on a simple framework describing what drives positive cash flows. The approach provides a conceptual way of evaluating business opportunities and using past experience and data to estimate future results. It can be extended into models that provide estimates of future cash flows and the possibility of running quantitative what-if scenarios and parameter optimization for the different strategies under consideration. Although the results may be quantitative, consider them only as approximations, not as a crystal ball giving future cash flows to the nearest cent. Even when not quantitative, the approach creates a useful framework identifying the different key variables driving corporate profits up or down.

Some authors argue that there is little meaning in attempting to arrive at accurate predictions given the inherent uncertainty in the marketplace.[4] However, it is hard to find a venture capitalist

who does not want to see future financial projections as part of the business plan or a corporate manager who says "yes" to a new project without any financial estimates. And there is a general trend toward using more quantitative methods in business.[5] As long as we understand the uncertainty of the projections we develop, the process of developing quantitative (or semi quantitative) estimates can actually open our eyes to aspects otherwise easily overlooked.

A variety of quantitative approaches are used today. Companies operating in well-established environments employ many tools for estimating the expected cash flows; from extrapolation of historical data or comparison to baseline figures obtained from best practice evaluations. And operations research gives us the tools to improve the efficiency in manufacturing, procurement and logistics.[6] While these tools can improve the corporate profits significantly, they are rarely used to form a new corporate strategy. One of the few cases where this took place was when the Canadian Pacific Railway changed its entire corporate strategy in the 1990s based on an operations research analysis. As a result of this, Canadian Pacific Railway saved several hundred million Canadian dollars and significantly improved customer satisfaction.[7] Of course, the railway business is centered on logistics, where the operations research approach is essential, and it would be hard for businesses in most other sectors to replicate the company's success. When it comes to less structured business problems the required mathematical modeling tools will have to be correspondingly more advanced (e.g., based on competitive biological systems)[8]. These models may use complexity theory and other advanced math. While this approach adds a much-needed quantitative dimension, it often includes some black-box component that is not transparent to the manager, and it is too complex to be practically usable by the majority of business practitioners.

The approach used in this book is generic and transparent. Besides allowing for quantitative estimates, this book provides both a framework that can assist the reader in understanding why the results are the way they are. The book is especially useful when it comes to evaluating the market potential for new products where there are no relevant historical data and where the current customers cannot even imagine the product.[9] For those products there is still a lot we can learn from historical sales data relating to other products because of the way customers repeat their logic, rationality and constraints to *any* purchase decision. By understanding that rationality it also becomes possible to understand why the adoption of a new product takes place the way it does—rather than just trying to calibrate empirical technology adoption curves.[10]

Besides facilitating business decisions, a rigorous approach helps communicate business decisions to both investors and employees. Lawyers can use the same tools to estimate foregone opportunities. The toolbox can also be used to evaluate the potential impact of specific risks. For example, what might the impact of a recession or a war be? Even for nonprofit organizations the method offers the opportunity to identify ways of creating the largest positive impact on a community with the least resources, in that case the profit is not measured in monetary units, but in impact.

---

1 Literature on radical innovation includes: Clayton M. Christensen & Michael E. Raynor, 2003, *The Innovator's Solution, Creating and Sustaining Successful Growth*, Harvard Business School Press, 304 p. and W. Chan Kim & Renée Mauborgne, 2005, *Blue Ocean Strategy, How to Create Uncontested Market Space and Make the Competition Irrelevant*, Harvard Business School Press, 240 p.

2 Examples of projects that took major tolls on large corporations are Ford's Edsel brand and Corning's microphotonics work.

3 Jeffry A. Timmons, 1995, *New Venture Creation: Entrepreneurship for the 21st Century*, 4th edition, McGraw Hill College Division, Boston, MA.

4 Eric D. Beinhocker, 2001, Robust Adaptive Strategies, chapter 6, pp. 131-155 and Richard T. Pascale, 2001, Surfing the Edge of Chaos, Chapter 5, pp. 105-129 both in Michael A. Cusumano, & Constantionos C. Markides (eds.), 2001, *Strategic Thinking for the Next Economy*, MIT Sloan Management Review, Jossey-Bass, A Wiley Company, San Francisco, 317 p.

[5] J. Doyne Farmer, Martin Shubik & Eric Smith, 2005, Is Economics the Next Physical Science, *Physics Today*, vol. 58, no. 9, pp. 37-42, September 2005.

[6] Examples include: Raymond R. Mayer, 1982, *Production and Operations Management*, McGraw-Hill Book Company, New York, 654 p.; Alain Patchong; Thierry Lemoine & Gilles Kern, 2003, Improving Car Body Production at PSA Peugeot Citroën, *Interfaces*, vol. 33, no. 1, pp. 36-49, Jan.-Feb. 2003; and Martin K. Starr, 1978, *Operations Management*, Prentice-Hall, Englewood Cliffs, NJ, 618 p.

[7] Phil Ireland, Rod Case, John Fallis, Carl Van Dyke, Jason Kuehn & Marc Meketon, 2003, Perfecting the Scheduled Railroad: Model-Driven Operating Plan Development, presentation at INFORMS conference on Creating Value in the Extended Enterprise, Phoenix, Arizona, 4-6 May 2003.

[8] E. Bonabeau, 2002, Predicting the Unpredictable, *Harvard Business Review*, vol. 80, no. 3, pp. 109-116, March 2002 and E. Bonabeau, M. Dorigo & G. Theraulaz, 1999, *Swarm Intelligence: From Natural to Artificial Systems*, Oxford University Press, 288 p.

[9] Justin Martin, 1995, Ignore Your Customer, *Fortune Magazine*, vol. 131, no. 8, pp. 121-126, 1 May 1995.

[10] E.g., Vijay Mahajan, Eitan Muller & Frank Bass, 1990, New Product Diffusion Models in Marketing: A Review and Directions for Research, *Journal of Marketing*, vol. 54, pp. 1-26 and Johan Norton and Frank Bass, 1992, Evolution of Technological Generations: The Law of Capture, *Sloan Management Review*, vol. 33, no. 2, pp. 66-77, Winter 1992.

Chapter 2
Learning

Improving profits has its roots in our ability to learn. Good business decisions are often based on a combination of detailed knowledge about the market and intuitive foresight, making it impossible to replace a skilled business leader with a computer based decision system. But we can aid the leader by turning data into useful information. If we can increase, by a few percent, the chances of success among the projects targeting new business opportunities, then that can be huge in terms of earnings. This is especially true for projects where large initial investments are justified by expected high subsequent margins, so the sunk cost will be high if the project is aborted after launch.

Many companies that quantify efficiency also become good at optimizing it. But quantifying a new business opportunity is harder and seldom done with precision. Most companies take a different approach to generating useful information when it applies to business decisions rather than engineering decisions. Had it been a company that was going to build an entirely new type of tire, it would probably have built a computer-based model of the tire and used that model to understand its performance and show where the tire might fail under extreme load and temperature conditions, even before constructing the first prototype.

But the same company would most likely not build a model showing the market potential for the tire and under which extreme market conditions the business might fail. Why not? The tire obeys the laws of physics, and the properties of the materials used in constructing the tire are known, or can be experimentally determined. A business, on the other hand, is much more complex and less well understood. Business is to a large extent driven by human behavior, a behavior defined by people having individuality and often providing an element of surprise, so we lack the same cut-and-dried “laws of business” that could help us analyze new business opportunities.

For new products, customer surveys often seem a great source of insight; however, it can be a challenge to survey customers in a way so we really get the information needed:[11] It is easy to identify “average” wishes or what people in general think somebody in the market might want, but they may not reflect the desires of any “real” customer. It is also easy to find value drivers that people would like themselves; however, when it comes to paying for them, they realize that their dreams are larger than their pockets. Therefore, historical market data may be more reliable. The statements here may not apply equally much to industrial markets where customers often work with well-defined budgets and purchasing procedures; here a customer survey may be more “reliable.”

However, it takes skills using historical data when it comes to new products. When products like the Post-It notes and the Palmtop were launched they did not replace any preexisting product, making an extrapolation of historical market data useless. However, people did have the needs that these products satisfy, but used other means of satisfying those needs, e.g. they might write a reminder on their hand, or make a note in their calendar. When the new products were introduced they changed their spending pattern to include them in their purchases. So in order to predict the sales volume of an entirely new product yet to be introduced we cannot extrapolate historical data, but instead we need to use the historical data to reveal peoples motives and rationale for buying. The problem of analyzing and optimizing business opportunities can be addressed in

different ways depending on how complex the problem is and how different it is from our past experience (Figure 2).

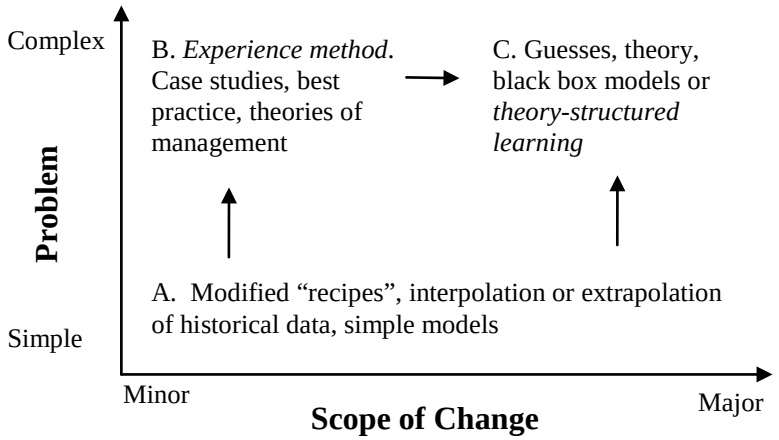


Figure 2. Methods of analysis

For simple problems (Figure 2, area A) we have quite a selection of tools available, from already tried "recipes" to interpolation between historical data points. If we have well-established theories or adequate amounts of data available we may be able to develop a model that can be used to estimate what we would like to know. Today, modeling is extensively used as a basis for developing and improving manufacturing processes. It is also finding an increasing role in business processes development and decision making as well. For example, operations researchers use linear programming to optimize logistics or work scheduling.

Experience Method

In some situations people seek to launch a me-too business or make a variation of a product that the company has been manufacturing different incarnations of the last 50 years. In these cases the complexity of the problem is high, but it resembles closely problems that have been solved in the past (Figure 2, area B). Under those circumstances, learning from past successes and failures is often the way to go and there are good reasons for the widespread usage of business case studies and best practice compilations.

Experience is the art of the skilled operator, and the judgment by the savvy business manager. Experience- and intuition-based approaches prove useful in complex environments with extensive variability and little data. It is taught through apprentices and case studies, but to be successful the practitioner often needs a feel for the problem and intelligence that cannot easily be documented or replicated. A real challenge is that it is easy and tempting to draw conclusions based on one irrelevant data point, such as a case study from a company that might have superficial resemblances to the problem at hand. It is not that experience from a steel mill bears no relevance in a hospital or Internet company environment; the problem is to know what aspects of that experience should or should not be applied in the new environment. These approaches leave it up to the user's cognitive abilities to generalize them in a manner that allows them to be

successfully applied to different situations. Some may even limit our ability to step outside the boxes they define.

Best-practice studies can establish what is best-in-class, measure a company's performance relative to the best competitors, show how others have managed to get there and use ideas from similar businesses as a resource for designing improvements. Although it has been widely applied, the approach has clear shortcomings. First, there is no guarantee that the companies used to define the "baseline" are anywhere near peak performance, and the method is not good at supporting innovation that will leapfrog the competition. Second, it is not always possible to successfully implement the best practice methods in a company with a culture significantly different from the culture in which it originally developed. Third, it is harder for the employees to take ownership of and feel enthusiasm for methods that are being imported into the organization.

Major Change and High Complexity

The real challenge comes when the scope of change is major *and* the complexity at the same time is high (Figure 2, area C). A very innovative product or a totally unproven business strategy typically falls in this group: the complexity is high because of the many interrelated aspects that make up a business and its environment, and the change is large because it breaks with the existing ways of doing business. The easy way out is to say "a guess is the best we can do." This argument could even be defended as some researchers argue that there is a minimal penalty for not using optimal game theory solutions, especially in complex competitive environments[12] and other researchers find that profitability correlates negatively with extensive business data collection and processing.[13] Some authors[14] argue that theory, not data, can help us analyze problems that differ significantly from what we know, in particular radical innovation. However, theory without data gives only qualitative results. Qualitative results can be useful in many situations: in terms of evaluating projects they may, for example, identify one alternative that is better than another.[15] But what if none of the alternatives are worth pursuing? In order to answer that question it is necessary to derive results that tie directly into the financial projections, which, of course, are quantitative in nature. And quantitative relationships build upon data.

The huge quantities of data that are becoming available from business and government sources can be impossible for a human brain to digest in an unbiased manner without the aid of mathematical procedures. Identifying patterns and trends exclusively based on data may take its beginning with simple regression analysis, but there are many other and more advanced methods. Some of the data-based models are black-box models with inputs (e.g., product characteristics and marketing investments), outputs (e.g., sales), and some empirical relationships that relate inputs to outputs. The empirical relationships could be developed using artificial intelligence or neural networks to identify which inputs are relevant and which type of equations would be suitable approximations. Experiments using this approach on business problems turned out to yield good results for simple problems, but often poor results when the systems were complex in nature. Even with very large data sets there still was not sufficient data available to build solid models for the more complex problems. The "shortage" of data is, however, generally the rule rather than the exception. Besides that, if there is "sufficient" data for the more complex business problems, the quantity of data becomes so overwhelming it's a challenge to manage and process.

Another major drawback of this method is that it often adds little to our understanding: while a correlation (e.g. good r^2 in linear regression) is a good way of describing the data, it tells us little about any possible underlying cause-effect relationships. That X and Y has a high correlation coefficient, does not mean that Y depends on X, as there may be a common cause influencing

both X and Y. However, in order for us to make predictions about the future we need to identify the underlying cause-effect relationships. We can do that in various ways: (1) perform controlled experiments, (2) use statistical methods where we first assume all possible relationships, and then subsequently prove that all but a few are not significant or (3) use prior cause-effect knowledge proven independently – here referred to as *theory-structured learning*. The third approach makes a lot of sense because it reduces the need for data, and we do not need to rediscover what is already known.

Theory-Structured Learning

Malcolm Gladwell looks at a human's ability to under certain circumstances make amazingly accurate decisions based on brief first impressions.[16] Some of his observations have direct implications for analyzing business opportunities for new products. First, you may be able to find more truth about people by observing them than by asking them about themselves.[17] The lesson from that is that customer surveys and focus groups, no matter how much effort people make toward being honest, may not predict actual future purchase behaviors. However, observing what they do today may be a predictor for how they will react tomorrow, even when faced with an entirely new product. Secondly, it is possible to make accurate assessments based on a short time of observation (small data sample) if you know the important few things to look for.[18] The general relationship models tell us what to look for and when we are equipped with that, it is possible for us to extract meaningful learning from an incomplete data set.

Dealing successfully with large changes in an unstructured environment (Figure 2-C) can be approached either from an experience base (Figure 2-B) or by taking an analytical approach (Figure 2-A). While distinctly different at first sight, the two approaches become increasingly similar as more advanced methodologies are employed (Figure 3). Gladwell gives an example of a researcher who started out building a mathematical model to make forward predictions and eventually became so familiar with the subject that he could make those predictions out of his head, thereby taking a cognitive approach to something that started as a math-based model. However, people new to the field could not, and the model was a necessary learning tool.[19]

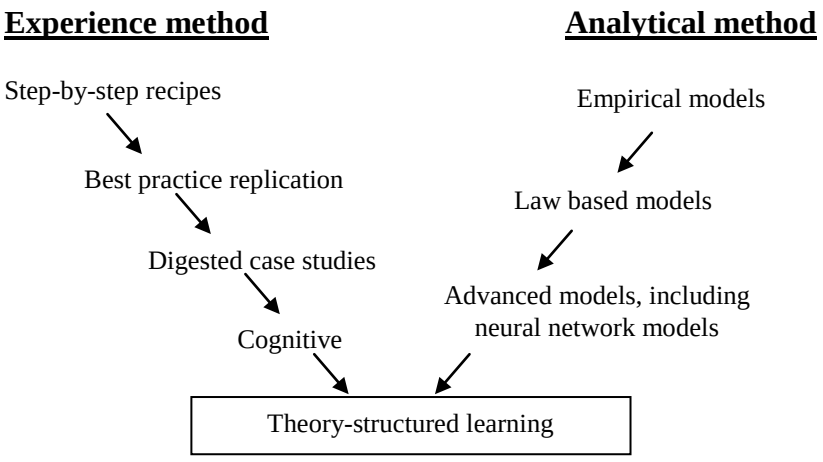


Figure 3. Levels of analysis in the Experience and the Modeling methods. Each step down will normally include aspects of all of the steps above it

Analyzing business opportunities is almost like driving a car. It is an ongoing process from the beginning of the trip to the end; not at any given moment is the attention removed from the road. Initially we learn the rules of the road (theory, model), but eventually they are embodied in our driving habits to a point that we take the correct decisions even without thinking about it. Observations about the road conditions and other drivers (data) are constantly being gathered, structured and interpreted based on the theory.

The art of business analysis often boils down to identifying patterns of relevance based on a confusing mess of individual observations about companies, markets, technologies and so on. Fundamentally, it resembles the job of an artist presenting selected aspects of reality in a painting or a physicist deriving a general equation based on numerous laboratory experiments. The "patterns" identified by the business analyst, the artist and the physicist all put us in a better position for understanding the world around us, and making better decisions about what to do next. Above we discussed pattern identification based on data or preexisting theory. In theory-structured learning both are combined, often leading to superior results. Cherkassky & Mulier argue that in order to identify causality we need both.[20] In theory-structured learning we use prior knowledge about the general relationships to make the most out of the data available. One could argue that it is force fitting data to a model; however, one can equally well argue that it is a way of building on what we already know, to avoid having to discover everything over and over again. The learning process taking this approach is illustrated in Figure 4. At an abstract level, theory-structured learning is not any different from the way humans learn: we receive information from the surroundings and, by combining that with our existing experience and reference framework, we derive new knowledge. Knowledge is like a value driver, formed through the combination of a need (a problem) and a solution to that need (relevant information and data).

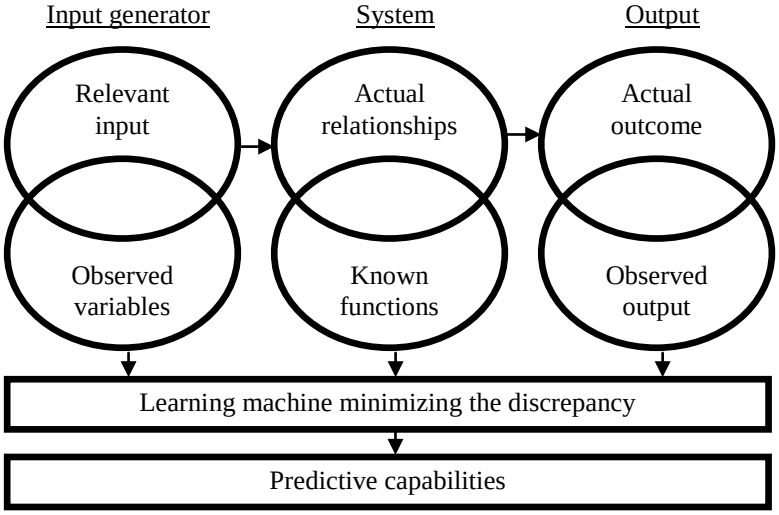


Figure 4. Schematics of the theory-structured learning process. The upper row of circles represents the actual systems, and the lower row represents what we know. The overlap between the upper and lower rows represents what is both known and relevant. The size of this overlap is critical to our ability to learn.

The predictive capabilities will be limited by how much of the relevant data is known and by our knowledge of relationships (known and relevant functions). But even if our knowledge was complete we cannot expect a totally precise and unequivocal answer because there is always the chance of someone doing something unexpected which may even be totally irrational. In that respect business is like quantum mechanics, even if we knew everything about the past we cannot accurately predict the future – all what we can do is provide a probability distribution reflecting possible outcomes. But that is still very useful.

Even if we knew everything about the past we cannot accurately predict the future

While the combination of theory and data often is the best overall solution, the question is what theory and which mathematical tools are most suitable for analyzing the financial viability of proposed business initiatives? As there are ample excellent books on data analysis, this book does not cover that aspect of the theory-structured learning process, but focuses instead on the theory aspect.

Many theories are handicapped by using past business failures and successes to extract some basic "lessons learned" that would have given a business an advantage at that time, but unfortunately they often cannot reveal the lessons before the fact. An example of this is the concept of network externalities,[21] which did not catch on in the management literature until long after some businesses relied on it in their strategies. With the pace of business today, "old lessons learned" are like expired patents: they provide value to the society at large, but normally they do not offer much of a competitive advantage to leading-edge businesses.

The larger the deviation from status-quo, the more fundamental the theory needs to be in order to remain applicable. For example, looking at the growth of the cell phone market we can use theory (e.g., technology adoption models)[22] and data (historical cell phone sales) to estimate how it may evolve over the next few years. However, if we were looking to introduce the first wireless phone ever, we would need a much deeper understanding of a number of different factors determining the success or failure, including:

- Customer budget constraints versus product cost and cost of ownership.
- The customer needs, including data on communication needs in different environments.
- Customer risk adverseness. A new product possesses a risk, but data from other launches of radical innovative products may help us map out customer risk tolerances.
- Marketing effectiveness. Here again we can learn from other new products launched.

So analyzing businesses that derive their competitive advantage from "breaking all the rules" can be a tall order. However, it is not impossible, because even if a business breaks the rules, the customers they serve are still humans, who react like humans, and we can seek to understand that. While many ways of formulating a fundamental, internally consistent and generally applicable theory exist, there may not be any single right or wrong way. In physics we find different theoretical descriptions of the same phenomenon, e.g., light may be treated as a wave or as a particle. Neither description is wrong; however, neither is complete. Much the same holds true for business. This book is one attempt to bring together ideas from a variety of different disciplines into a single framework suitable for analyzing the financial viability of new business

opportunities. In cases where quantitative data are not available in sufficient quantities, it is still possible to identify overall trends, and possibly quantify relative changes without developing exact numerical models. Independent of the specific approach taken, some rigor will benefit the accumulation and processing of information. The general process is illustrated in Figure 5, and a few of the areas discussed further in the remainder of this chapter.

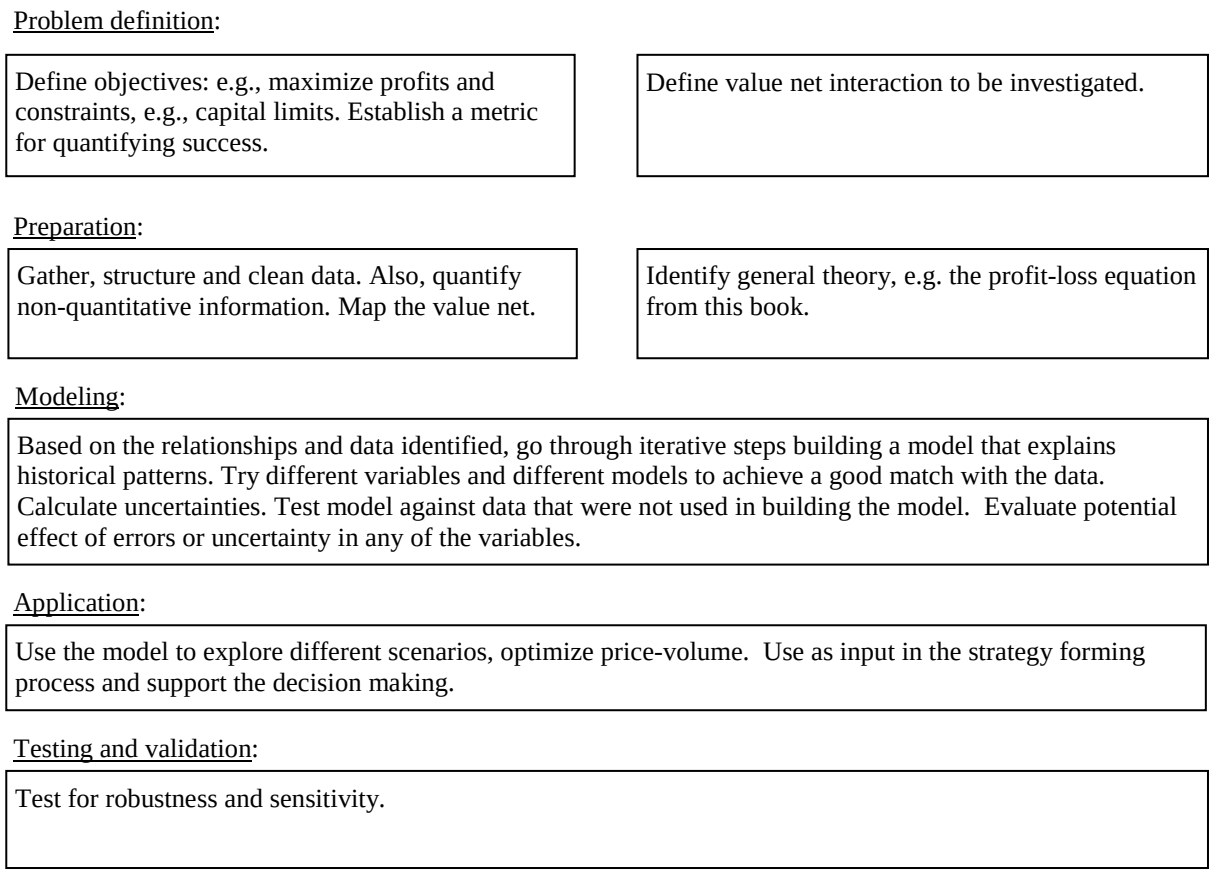


Figure 5. Conceptual steps of building a profit model

Data and Knowledge

Knowledge management[23] and management information systems effectively capture and deliver knowledge and data of importance to the various parts of a business, but are rarely designed to support the type of work described in this book. Likewise government statistics often include useful data that cannot be used as-is. This book is not about knowledge management or management information systems. However, a few of the issues directly related to quantitative data needed to evaluate profit opportunities are addressed.

The value of the product or service will differ depending on the node, so we must determine the value in each node of interest; however, doing so can be a challenge. Associated with each node in the value net is a vector that describes its perception of values. As the information depends on the context, it is good to collect a broad range of context information and relate it to the vector. Semi-quantitative measures are often better than no measure at all. And quantitative results benefit from estimates of the uncertainty—which occasionally can be quite large.

There may be variables we intuitively know are important but have no quantitative data on. In those cases we can incorporate empirical sub-models based on our experience and intuition or we can create pseudo-variables by assigning arbitrary numbers to different levels, e.g., rating brand equity on a scale 0-10.

While well-established businesses over the years gradually developed a tradition for how to gather and process information, this tradition may not be well aligned with today's needs. How to establish a system for collecting and processing information is particularly pertinent during the formation of a new venture or the creation of a new product where data and knowledge growth is particularly rapid.

Modeling

After the information has been collected, structured and analyzed, we can turn to the usages described in this book. With robust models or at least well-structured knowledge, we can draw conclusions and support the creation of ideas. A note of caution: if a parameter is left out of a model it is de facto assumed to be "average." For example, in the case of the *smart fortwo* (Chapters 12-13) the number of dealers was much smaller than for the average car, and it was not until dealers were included in the model that the results became realistic. Therefore, the lack of certain data (the upper part of the top left circle in Figure 4) can sometimes cause considerable problems.

Testing and Validation

We can run sensitivity analysis at different levels. The easiest is to investigate the effect of errors/variations in the various input parameters. If we develop quantitative models, the data might not only be the basis for developing the model, but data not used in defining the models can be used for testing the validity of the models. Often we can build more than one model describing the same problem, and by comparing results from these different models we can get a feeling for how far off the results may be by adopting a given model and how robust the models are.

A general problem for all methods is how to ensure that the validity of the conclusions extends beyond the limited historical data on which they are based. A few precautions can be taken:

- All historical data sets should include metadata covering key characteristics of the "setting" or environment. It will never be exhaustive, but should enable the user to acquire a "feel" for the setting from which the case studies or data originate.
- Look at the variables that in turn influence the parameters in question. If sales depend on TV commercials, do not look only at target audience and stations, time of week and programs this audience watches but also determine why the viewers look at those times and why they like those programs. In that way even changes in TV consumption patterns among the target audience can be anticipated.
- Be open to selecting or reselecting new key parameters. A preconceived notion of what is going to be important can be dangerous.
- Generalize to see the more fundamental patterns. For example, consumer purchasing patterns may be governed by basic physiological behavioral patterns. If these "laws" can become part of the model, it is significantly safer to extrapolate into unknown territory.

[11] P. G. Moore, 1970, The Myth of the Percentage Sample, *The Journal of Management Studies*, vol. 7, pp. 144-155 and S. L. Payne, 1951, *The Art of Asking Questions*, Princeton University Press, Princeton, NJ, 249 p.

[12] Robert J. Meyer & Darryl Banks, 1997, Behavioral Theory and Naïve Strategic Reasoning, pp. 151-176 (Chapter 6) in George S. Day & Robert E. Gunther (eds.), 1997, *Wharton on Dynamic Competitive Strategy*, John Wiley & Sons, Inc., New York, 465 p.

[13] Kathleen M. Sutcliffe & Klaus Weber, 2003, The High Cost of Accurate Knowledge, *Harvard Business Review*, vol. 81, no. 5, pp. 74-82, May 2003.

[14] For example: Clayton M. Christensen, Scott D. Anthony & Erik A. Roth, 2004, *Seeing What's Next, Using the Theories of Innovation to Predict Industry Change*, Harvard Business School Press, Boston, MA, 310 p.

[15] Alexander B. van Putten and Ian C. MacMillan, 2004, Making Real Options Really Work, *Harvard Business Review*, vol. 82, no. 12, pp. 134-141, December 2004.

[16] Malcolm Gladwell, 2005, *Blink, the Power of Thinking Without Thinking*, Little, Brown and Company, New York, 277 p.

[17] Gladwell, op. cit., p. 39.

[18] Gladwell, op. cit., p. 32.

[19] Gladwell, op. cit.

[20] See p. 9 in Vladimir Cherkassky & Filip Mulier, 1998, *Learning from Data; Concepts, Theory, and Methods*, Wiley Inter-Science, New York, 441 p.

[21] E.g. Kevin Kelly, 1998, *New Rules for the New Economy, 10 Radical Strategies for a Connected World*, Penguin Book, New York, 179 p. and W. Brian Arthur, 1996, Increasing Returns and the New World of Business, *Harvard Business Review*, vol. 74, no. 4, pp. 100-109, July- August 1996.

[22] E.g., Vijay Mahajan, Eitan Muller & Frank M. Bass, 1990, New Product Diffusion Models in Marketing: A Review and Directions for Research, *Journal of Marketing*, vol. 54, pp. 1-26, January 1990.

[23] Tom Davenport & Gilbert Probst (eds.), 2000, *Knowledge Management Case Book, Best Practices*, Siemens, Publicis MCD Verlag, John Wiley & Sons, Munich, 269 p.

Chapter 3
Value Nets

The value chain follows the flow of goods/services one way and the flow of money the other way. The value net[24] also includes all the constituencies that directly or indirectly influence the creation or destruction of value of products or services delivered by the business. For example, a friend of the customer, who is influencing the customer's purchasing decisions, is part of the value net but not the value chain.

When Harley-Davidson decided to support clubs for their customers,[25] they recognized how customer-to-customer relationships could at the same time enhance the value of its products. Only recently have we discovered some of the fundamental characteristics of value nets, in part thanks to the Internet where the number of nodes is large and the transaction costs low, creating extreme forms of value nets. However, the fundamentals of the value net apply equally well to a seventeenth century blacksmith as to an Internet company.

Each constituency in the business landscape is here regarded as a node in the value net. The same node often plays multiple roles, e.g. as a customer, a competitor, a supplier and an influencer. First order nodes interact directly with us, such as our customers. Second order nodes are the next step out, e.g., the bank that a customer gets a loan from to buy our product. A study of factors responsible for driving General Motors (GM) Company's stock prices[26] revealed the significance of the interest rate on car loans. Originally, car loans were offered by banks that are second order nodes; however, GM realized the importance this has to the purchase decisions by car buyers and decided to offer in-house financing like some of the other car makers. Effectively GM restructured the value net by acquiring the functionality of one of the second order nodes; it ensured that complements (loans) necessary for success could be provided on the terms optimal for its business.

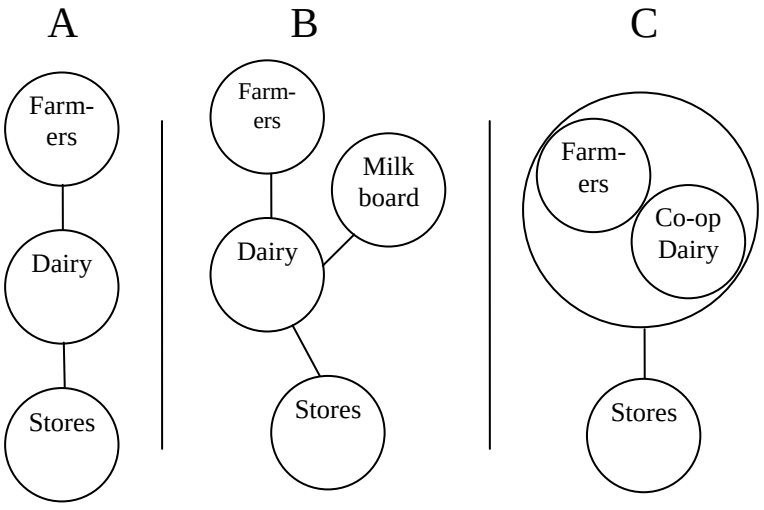


Figure 6. Three different value net configurations for milk processing

Figure 6 illustrates three different value nets associated with the processing of dairy products. The value net to the left (A) is simple: the farmer sells milk to the dairy that processes it and then sells it to stores. While simple, that value net has a major drawback: the elasticity of demand is

different for different products, which means that an optimal solution for the dairy will limit production of certain milk products. That in turn reduces demand for milk and consequently puts some farmers out of business. As that is politically undesirable, the U.S. government influences milk prices according to the usage of the milk[27] (Figure 6-B), making it possible for the dairies to increase production of a wider range of products, thereby keeping more farmers in business and giving consumers the opportunity to increase their consumption of milk based products. However, the prices have less to do with free market prices, and there is little natural regulation in that market. A third alternative (Figure 6-C) was used in Denmark around 1900 where about 80 percent of the total milk was processed by co-op dairies owned by the farmers.[28] In that value net the interest of the dairy coincided with the interest of the farmers, and the dairy would set the pricing of the products so they would benefit the farmers, rather than merely making the dairy most profitable. The drawback of this value net is that the small coop dairies close to the local farmers were not competitive against large commercial dairies.

The health care value nets are configured differently in different countries. In some places the decision makers (doctors and patients) are separated from the nodes paying the bills (health insurance company), giving them limited incentives to save (Figure 7-A). In other countries the health insurance, doctors, and hospitals are bundled into one node, like a public health care system, leaving pharmaceutical companies and patients with less power (Figure 7-B). The latter value net certainly makes it easier to manage cost, and could lead to taking a more proactive stance on keeping people healthy. But there are fewer incentives to keep waiting lists down.

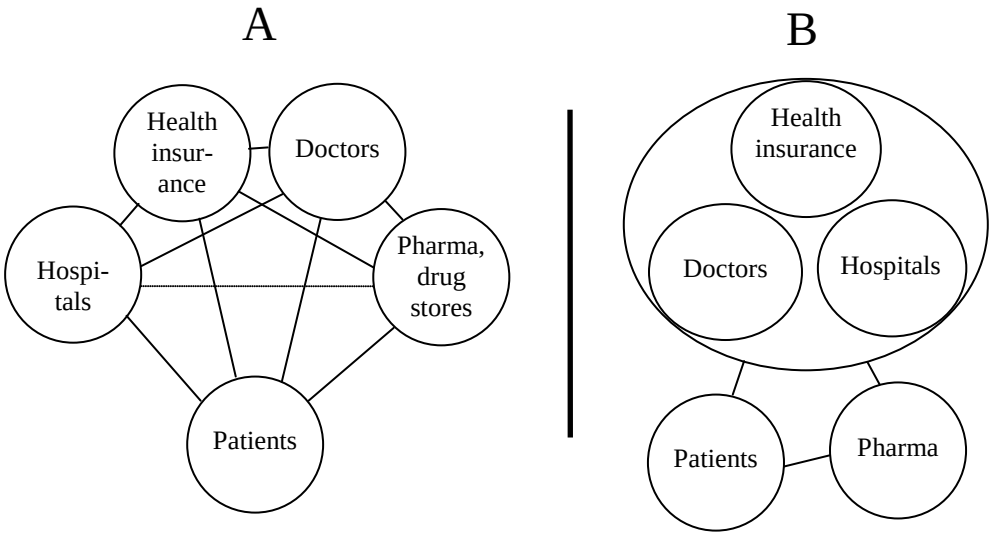


Figure 7. Two health care related value nets

Even in case of the most stable businesses, new surprise nodes may pop up in the value nets. The Inuits in Greenland had been selling seal skin for centuries through the Royal Greenlandic Trade (KGH) when Greenpeace initiated a campaign against the killing of seals. With this new node influencing their customer's customers, the Inuits found their market dwindling. They used to hunt the seals for both skin and meat, so now they just hunted them for the meat, leaving the un-sellable skins on the shores. Without the income from the skin trade they could not afford traveling so far on their hunting trips, which led to an increase in the consumption of imported food and an increase in the seal population. The growing seal population represented a node in

the value net of the people fishing: the seals reduced the amount of fish in the sea along the Greenlandic coast to a point that it was difficult to maintain the volume of fish caught by the people fishing—and some of them started killing seals just to keep the population down and the fish population up. This example illustrates how a remote node (Greenpeace) in the value net had a major impact on the business of both seal hunters and the people fishing.

Sometimes we cannot associate a node with a specific person or entity; for example, we may not know who contributed to a charitable fund that helped us, but it is still important to identify the anonymous donor as a node. Not every node represents even a human or a human organization, but they could be crop-eating insects or a severe hurricane.

One "customer segment" we often overlook is the ones who do *not* buy.[29] We may spend money on ads targeting them and they may provide us with valuable feedback and understanding of problems in the current business, so they are an important part of the value net, yet just because they do not create a monetary income they are too often ignored.

While some value net changes, like the appearance of a new competitor, often are beyond the control of the company, other changes result from conscious decisions by management. It could be the decision to outsource or introduce a two-tier supplier structure. It is often possible to "invite" new nodes in or "exclude" existing nodes from the value net. We may, for example, invite a provider of complementary services in by creating a mutually beneficial customer referral program and joint promotions. Or we can exclude nodes, e.g., by setting the price so certain customers no longer can afford the offerings.

The further away in the value net a node is, the less we know about it, and the harder it is to influence. Many of the distant parts of the value nets originated from moves by competition, customers and government. Unfortunately, much of the value for any business is created in these more distant parts of the value net, and long-term success will depend on reaching these parts. Furthermore, some of the most successful businesses have induced radical changes in the entire value net through the design of entirely new value constellations. Especially, successful launches of radical innovations oftentimes require substantial value net modifications. So we may have to take a more proactive role in the design of better value nets.

The value net includes everyone who directly or indirectly is important to the company

Resolution

The concept of a value net is fairly straightforward; however, there are choices in how detailed to make them. In particular, when should nodes be treated as a block and when should they be treated individually? As a general rule, the number of nodes should not be larger than the company (or person) is able to deal with on an individualized basis.

The better organized the value net is, the more structured the interactions are, the more information technology is used and the better the humans are at dealing with complexity, the more nodes can be handled. On the other hand, the more individuality each node requires, the fewer nodes can be handled. If the nodes are employees in a company, we may find that a supervisor interacts directly with 10-15 subordinates, and if the job functions are complex, the supervisor cannot maintain efficiency if this number gets much larger.

By having each subordinate supervise other people, we can grow the organization without exceeding the supervisory capacity. Effectively we lump each subordinate and the subordinate's subordinates into one node, thereby reducing the complexity in the value net and maintaining efficiency. On the other hand, if a commander orders a hundred people to perform the same task at the same time, then there is little individual information about each node required, and the commander can handle the larger number of nodes without losing efficiency.

Ha Hoang argues that as the number of business alliances a company forges goes up, so does the complexity of the managerial task, and eventually the company cannot successfully harvest the full benefit of each alliance.[30] The toymaker, LEGO, manages a large number of alliances, but does so by using a well-defined alliance agreement with each partner, thereby easing the managerial task.[31] Effectively what LEGO had done was to reduce the individuality of each alliance node.

Car makers face the task of procuring many different parts. They do it by having standardized supplier agreements, extensive usage of IT systems and first-tier suppliers that their second-tier suppliers interact with—all aiming at reducing the complexity of the value net. Some companies employ value net simplification as their business model; it may be a wholesaler who procures merchandise from many different sources and offer it as a "one node supplier," or it may be computer consultant who helps companies integrate different software systems.

It is convenient to lump all customers together in one group, but often it will make more sense to treat each customer segment as one node. A consulting company may provide highly customized services to a limited number of customers, while a fast food chain may provide highly standardized meals to millions. The consultant will probably look at each customer as an individual node, while the fast food chain will look at customer segments as individual nodes. If a company acquires automated manufacturing tools with lot-size-of-one capabilities, we can only harvest the full economic benefits if we understand how each customer is different, and in that case each customer could be treated as an individual node; however, handling of the individualism is both simplified and automated.

During the 1970s and 1980s numerous companies were highly diversified conglomerates. In the 1990s most of these companies became much more focused, and many of them pursued only one line of business. The conglomerates benefited from cross-functional economy of scale and reduced market risk due to the diversification; however, they still could not compete against the more strategically focused companies that put all their human and financial resources into succeeding in a single market. The focused companies chose to focus on a smaller and more well-defined value net and to know more about each node in that value net. Apparently there is no standard answer to the question of how many or how few nodes the value net should be broken down into, but there are clear dangers of becoming overly ambitious by trying to treat too many nodes individually.

Internal Value Nets

Besides the external value net that includes customers and suppliers, we can look at the company organization as an internal value net. Companies often have choices in how to arrange the internal value nets and where to draw the boundary between "inside" and "outside," e.g., through the use of contractors and freelance workers instead of employees. During the 1990s many companies decided to focus on their core business and outsource some of the non-strategic functions, effectively moving functions from the internal to the external value net. Today, some businesses are further integrating outside resources, e.g. Research and Development (R&D) can

be done faster, more successfully and at lower cost by having the internal R&D employees join forces with external people and organizations that already have part of the solutions sought.[32]

Some companies have been reorganized to allow the various parts of the organization to collaborate on a peer-to-peer basis, effectively forming a more "natural" open-market style of internal value net (see p. 61). So how diffuse or how structured should the internal value net be? And how much of the value net should be under our direct control versus being under peer-influence? Analyzing the internal value net is not much different than analyzing the external value net, each employee, like each customer, having an interest in optimizing his or her own profits. Finding the right balance between value creation and value appropriation for the employees[33] can lead to larger overall business performance.

Designing Value Nets

Some new products and most radical innovations require a redesign of an existing value net. So, how should we design the value net to the maximum benefit? Unfortunately, it's often impossible to answer this question until we have gone through the whole process described in the following chapters, and then work our way back to the beginning. There may not be any right or wrong value net; however, the value net will influence volume and prices and is therefore a good starting point for the subsequent chapters. It is impossible to consider every node in the value net, so how do we select the most relevant ones? The next section discusses value drivers: the exchange of value among the nodes. As soon as we can quantify the value drivers each node provides, we can also identify the most important nodes based on their importance to company finances.

---

[24] Cinzia Parolini, 1999, *The Value Net, A Tool for Competitive Strategy*, John Wiley & Sons, Ltd., Chichester, U.K., 239 p.

[25] Richard F. Teerlink (former CEO of Harley-Davidson), 2005, How We Rebuilt a Great American Company, Inaugural Lecture in the William J. O'Brien Distinguished Lecture Series, College of the Holy Cross, Worcester, MA, 18 Oct. 2005.

[26] K. Tobias Winther, 2000, A Value Model for a Network and Leverage Economy, *Research Papers in Economics*, http://ideas.uqam.ca/, 28 p.

[27] See for example www.ams.usda.gov/dairy/orders.htm (viewed 3 Aug. 2005).

[28] Johnston Birchall, 1997, *The international co-operative movement*, Manchester University Press, p. 19.

[29] W. Chen Kim, & Renée Mauborgne, 2001, Strategy, Value Innovation, and the Knowledge Economy, Chapter 9, pp. 197-228 in: Michael A. Cusumano & Constantionos C. Markides (eds.), 2001, *Strategic Thinking for the Next Economy*, MIT Sloan Management Review, Jossey-Bass, A Wiley Company, San Francisco, 317 p.

[30] Ha Hoang, 2003, Is Your Company Over-Allianced?, *Strategy+Business*, issue 30, pp. 9-11, Spring 2003.

[31] Ha Hoang, op. cit.

[32] Larry Huston & Nabil Sakkab, 2006, Connect and Develop: Inside Procter & Gamble's New Model for Innovation, Harvard Business Review, vol. 84, no. 3, pp. 58-66, March 2006.

[33] Sumantra Ghoshal, Christopher A. Bartlett, & Peter Moran, 2001, A New Manifesto for Management, Chapter 1, pp. 9-32 in Michael A. Cusumano & Constantinos, C. Markides (eds.), 2001, *Strategic Thinking for the Next Economy*, MIT Sloan Management Review, Jossey-Bass, A Wiley Company, San Francisco, 317 p.

Chapter 4
Key Variables

In understanding why customers buy or don't buy something, we can start by looking at how a customer finds a solution to their needs or wishes. A product may have many different features and properties, which together solve a *few* basic needs or desires of the customer. Here the term *value driver* is used to describe those solutions. For example, independent of how many bells and whistles a clock boasts, it can be considered having just two primary value drivers: keeping people informed about the time and providing esthetic value. It may use different methods for telling the time: dials, a digital display, bells ringing at certain times, an alarm that goes off at a preset time, etc. – but they all support the same value driver. On the other hand, a product full of features that does not solve a problem for anybody lacks value drivers. So the important thing is the combination of a customer need with a product solution (Figure 8).

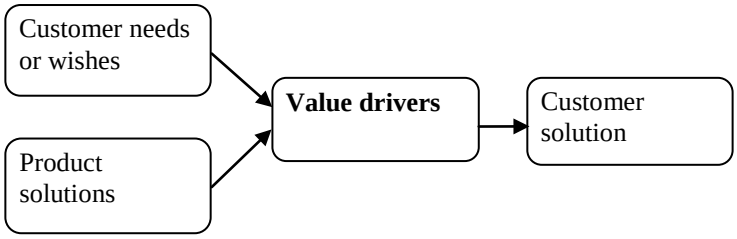


Figure 8. Schematics of value drivers

But that is only part of the story, if the product is unaffordable, or the customer cannot find the product, the customer still does not have a solution. In that way certain constraints are just as important as the value drivers in determining how much gets sold. Collectively all these variables are called the *key variables*. In some sense it is only when there is a profit opportunity, that a sale will occur and the customer buys a product which will contribute to a customer solution[34]. In a subsequent chapter it will be discussed how profits depend on value to the customer, risk, market power and cost, which are the four main groups of *key variables* (Figure 9). They represent the main things the product does for the customer and the main limitations the customer has. The key variables characterize the links between the nodes in the value nets.

Key variables can be described by an ideal *optimum* and by *constraints*. For example, an optimum is the ideal performance that the customer is wishing for; the constraint is that the customer cannot do his/her job unless the product offers a certain minimum level of performance. As a general rule, the optimum is most important to value drivers, and the constraints are most important to risk, market power and cost – although it is not always that way. However, for the sake of simplicity the three groups of key variables: risk, market power and cost are here called constraint variables.

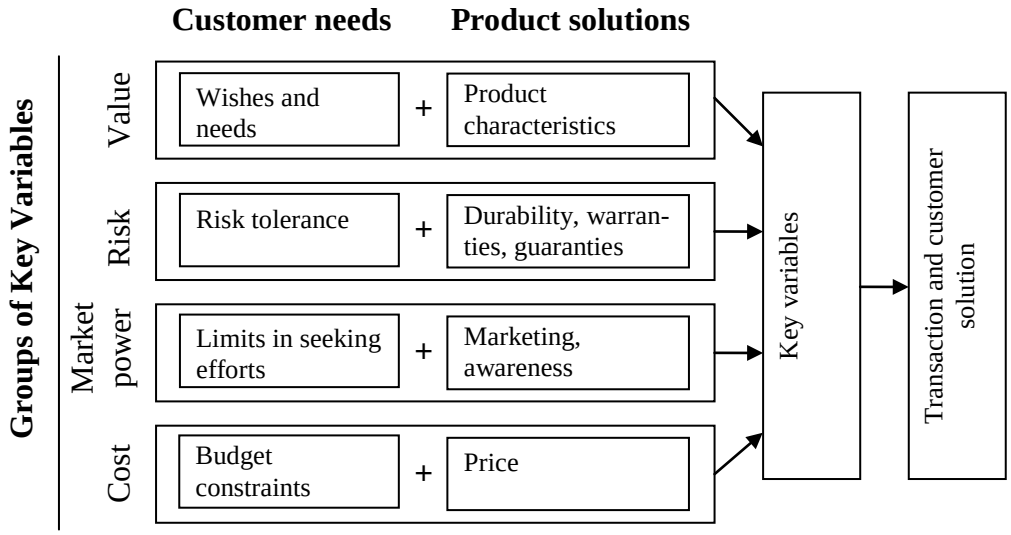


Figure 9. Schematic presentation of the processes leading to a customer solution. A sale requires that there is a product that can meet the customer needs in all four areas.

Value Variables

In this book a value variable, or value driver[35], is defined as a reason for any asset, product, service or act to become valuable to a person. In other words, it is the solution to a customer's problem (Figure 8). Often the value proposition captures some of the value drivers. Many value variables (and other key variables) are in common among multiple products and markets, e.g.: comfort, productivity enhancement, fun / entertainment, pleasure and social image building. A value driver like social image building is in part influenced by how the product has been positioned and marketed and what brand the product is sold under.

TV news or computer-based presentations usually offer two value drivers: information/learning and entertainment. Information is the message being conveyed, the entertainment may be pretty graphics or the way the speaker is dressed. For some people one value driver is more important then the other; for example, I encountered a person who always watched the TV news with the sound off and no text, evidently looking for the entertainment value driver only. Even for the same person, the relative importance of the two value drivers may fluctuate from one minute to the next; for example, if the subject suddenly turns to something of non-interest, the entertainment value driver takes over in importance, helping the listener stay tuned until the next interesting piece of information appears.

Product features that all support the same value driver can easily substitute for each other, in the sense that customers willingly trade one feature for another. So the aesthetics of a clock may be enhanced by a nice color or beautiful ornamentation, and a person may accept a color that is not perfectly matching his or her wishes in return for better ornamentation. That makes it possible to score products relative to each other by calculating averages of all the features supporting one and the same value driver. For example, we can rank sports cars by their performance (performance value driver) using an aggregate score based on time to get up to speed, top speed, handling abilities and braking abilities. Some value drivers cannot be described by one

continuous ranking, but can instead be represented by a number of distinct groups, where one cannot say that one group is more or less than another – yet their distinction is very important to the customer. For example, the taste style of prepared food could be classified in groups like Italian, hot Mexican, sea food, Chinese, etc. A couple looking for a restaurant may consider a subset of these groups, but not all. Some value drivers are mostly customer created, e.g. the social dimension of a social network website is created by the users not the company, yet it is often the most important value driver.

A value driver is not an inherent property of a product itself, so it is not something that a supplier can deliver in a box to a customer. It is not until the product is inserted into the customer's value net to solve the customer's problem that value drivers emerge. Therefore, the same product will have different value drivers to different groups of customers such as a tire used for a tire swing or on a car. Even with identical value drivers, the customers are likely to rate their relative importance differently. So, strictly speaking, from a value driver perspective mass market commodities are rare. But at the same time those differences mean that people willingly trade with each other, which is one of the most important properties of an economy.

Value Drivers that Matters

Simplicity is strength when it comes to understanding markets. It is easy to come up with a lot of reasons for a product to possess value, but it can be hard to analyze all of those reasons. Especially when we have to quantify the value drivers through surveys, customer interviews, special accounting procedures and extensive statistical searches, it can become expensive to collect data, so it is critical to focus on what matters. So what is that?

The only value drivers that really are important are the ones that in reality drive *current* and *future* purchasing decisions, and how much people are willing to pay. And usually there is only a handful of basic reasons for someone to decide to purchase something. To identify what that is, we must take an "in the customer's shoes" viewpoint of what the customer really wants accomplished. It has been argued that we often tend to think of others being similar to us, but in reality this may not be the case.[36] Therefore, it may not be enough to just sit down and imagine what we think they think, but rather we need to observe their actual behavior, in particular related to how they attempt solving their problems today. What makes it more challenging is that the rest of the world changes between the time we observe and the time we have the product ready for launch, so the question becomes, what will the customer think and feel under those new circumstances?

Both the customer and the supplier will bundle a product. The customer looks at value created from the entire bundle, which is not only the specific product being sold but also the sales experience, service, support and warranty. Customers insert the products they purchase into their world, meaning that value creation is subject to their needs, their skills and their abilities to acquire the complements required. So, a customer who creates tremendous value through consumption will be willing to pay more for the same product than a customer who does not have the same value-creating capabilities. It therefore becomes important to take the customer side value creation into account. In other words, the value drivers and the utilityscapes need to be sufficiently broad to cover the solutions the customers are seeking, not just the specific contribution our product makes to that solution.

When a customer stares at a shelf full of fairly similar products, he or she will make the purchase decision based on "something" which always boils down to being different in one or more of the value drivers. We should try to capture this "something" that differentiates our product from the competition. The customer's perception of value is what really matters, because

that is what he or she bases his or her purchasing decisions on. The perceived value will, to some degree, be influenced by the value received from previous purchases. In addition, in the longer term, repeat purchases will be influenced by the value actually received from the present purchase. However, purchase decisions never hinge on the actual value received because neither the customer nor the seller can know it for certain at the time of purchase.

Surveys of supermarket customers show that many of them will pay a surcharge for name brands over generic brands, even if they think that the generic brand has the same quality,[37] so a brand name may need to be factored into one of the value drivers, even in cases where it does not reflect anything about the direct utility of the product. In general, feelings and irrational beliefs influence purchasing decisions, while real facts that the customer knows nothing about exert no influence. Therefore, customer communication and education will influence which value drivers become important. This is extensively utilized in marketing and advertisement, although not necessarily driven by a value net profitability analysis.

Purchase decisions may be influenced by many other irrational perceptions[38] including: (1) some customers do not necessarily regard a sunk cost as something that should not influence future purchase decisions, (2) some customers follow past habits without re-evaluating their desirability today and (3) some customers do not even try to seek the optimal output if they do not consider the purchase important enough to spend time thinking about it. If the customer perceives the item as cheap, then he or she may ignore the negative value driver associated with the payment. These examples illustrate how customer rationality cannot be assumed in judging value driver importance.

We can look at the value as a combination of all the value-contributions that the different nodes are providing. If an essential complement to the product is not present, then the entire value vanishes; for a computer such a complement is electricity. If there are many supporting offerings, e.g., self-help guides, evening classes and user communities, then the value goes up.

We are used to thinking of value being something delivered by a supplier. However, in reality customers often beat anybody else at creating value for themselves and as a supplier the best we can do is to facilitate this process. So the unique dishes the AAKC user creates is what makes the whole experience worthwhile.

The value of a value driver changes as the value net which surrounds the customer changes. If you move from Norway to the Christmas Island, the value of your slalom skis will diminish as "complementary products," such as snow are lacking. Even a simple event such as a promotional campaign can create new perceptions of a product or make the customers discover new connections in the value net changing their ratings of the different value drivers. The dynamic nature of the value drivers can make their mapping challenging. However, for most problems a static view of the value drivers is good enough.

Constraint Variables

Just like there are a few basic needs that make a customer buy a product, the purchase decision will be governed by a few basic constraints such as budget constraints and channel / availability constraints. Most products cost time and money to acquire, maintain and use. And most customers set limits for the amount they are willing to spend; therefore, cost to the customer becomes a variable associated with almost anything. Sometimes customers distinguish between two cost constraints: up front investment and cost of ownership. If the customers know they must spend time figuring out how to use the product or spend time getting it fixed, even that will influence the purchase, and should concern the supplier. Companies that carefully map how the

customer spends time and money in connection with the solution they provide, and then identify ways of reducing these costs to the customer, take this variable serious.[39]

While a budget constraint is a continuous variable (like the transport value driver), the channel / availability constraint consists of a number of discrete groups (like the food styles), e.g. online availability or sold in stores in town X. If a customer only shops in the three largest stores within the city he / she lives in, then that becomes a constraint potentially limiting the sale. Store brands, geographic store locations, internet availability, payment options, channel awareness through marketing and sales staff abilities in specific stores will all contribute to limiting the customer access to the product. As needed we can construct one or more constraint variables, reflecting availability to the customer.

There may also be legal constraints (e.g. not to be sold to people under age 18) and customs / tradition constraints (e.g. purchase patterns directed by religious beliefs or sports events). One of the constraint variables is the competition. Like you can create a value driver by combining a set of features, you can create an aggregate "competition intensity" variable, by adding different factors of importance including the availability of similar products that could become a substitute.

Constraint variables are very similar to the value variables, in that they emerge as a result of a customer requirement in combination with a supplier solution. A sale will only take place if the price is within the range the customer is willing to pay. And the product distribution needs to cover part of the venues where the customer shops.

Shopping

A purchase normally consists of three distinct decisions:

1. Will the customer "invest" in the shopping activity at all, and if so, will our solution be one of the options considered?
2. Does our offer match the customer's needs? In other words, does our product meet the expectations in each of the value driver dimensions (cf. utilityscapes in the next chapter)? This question is a matter of value and risk versus customer expectations.
3. Compared to the alternatives, is our offering competitive? This question is about our market power, the cost to the customer and other constraint variables.

Only when the outcome of all three decisions is favorable do we achieve a sale. The previous discussion focused on the second and third question. The first question, however, follows the same rules of value, risk and market power. We can consider the purchase of a DVD. When the customer is already in the store, the shopping cost becomes a sunk cost, and will not influence which movie, if any, he or she buys. Before going shopping, the effort of searching for a movie is a variable cost: the customer may elect to forgo shopping at all, and instead spend the time on something else, in which case no purchase will be made. So if the store carries really good movies, the value goes up; if it offers a large selection and the customer is almost certain to find a good one, the risk goes down, and if there is nothing else to do in that town, the market power goes up—all contributing to increasing the chance of the customer going to the store in the first place.

Cost and Availability

Is the cost of the product within the customer's budget? That is the critical question, not the availability of a solution. Availability is often a question of money, and at "any price" most things are possible. With large enough a budget you may develop a solution—or be willing to

afford existing technologies, e.g. if you need electric power on a satellite you can use photovoltaic panels although quite expensive, just the $5,000 to $10,000 or more per-pound cost of getting them out in orbit[40] adds significantly to the cost. Yet, based on the vale they deliver, they are worth the cost. Availability falls into three groups:

1. Not available at current prices and budget constraints. For truly unavailable items the price is infinite and sales are zero.
2. Nearly competitive, e.g., electric heating in houses that could alternatively be heated with oil or gas.
3. Cost is a non-issue, e.g., rechargeable cell phones, where the cost of power used for the charger is negligible compared to the phone charges.

If the product is expensive, hard to get or something that it will take a lot of research to discover, all results in the same: a significant investment of time and/or money will be required by the buyer.

Data on a few key variables is all that is needed to know ***who will buy****, and* ***why***

---

[34] There must be an opportunity for a profit to the seller, *and* an opportunity for a profit to the buyer (value reduced by risk and market power minus price paid).

[35] Not all authors agree on the definition of the term value driver. An alternative usage of the term is found in Mark C. Scott, 1998, *Value Drivers, The Manager's Guide to Driving Corporate Value Creation*, John Wiley & Sons, Ltd.

[36] Jacquemin Alexis, 1987, *The New Industrial Organizations: Market Forces and Strategic Behavior*, MIT Press, Cambridge, MA, 217 p.

[37] Raj Sethuraman, 2000, What Makes Consumers Pay More for National Brands than for Store Brands --- Image or Quality?, *Social Science Research Network*, Paper ID 310883, code 020506600, 40 p., Posted 7 May 2002.

[38] N. Barberis & R. Thaler, 2002, A Survey of Behavioral Finance, *National Bureau of Economic Research*, Working paper #w9222, Sept. 2002.

[39] James P. Womack & Daniel T. Jones, 2005, Lean Consumption, *Harvard Business Review*, vol. 83, no. 3, pp. 58 - 68.

[40] Marco Cáceres, 2004, For Space Markets, Greater Volumes Remain Elusive, *Aerospace America*, vol. 42, no. 9, pp. 12-14, September 2004, (http://www.aiaa.org/aerospace/archives.cfm).

Chapter 5
Utilityscapes and Sales Volume

I was once asked, "How could one have known that the microwave oven would become such a success, considering that micro-waved food does not taste as good as food cooked by other methods?"[41] Food has at least three value drivers: nutrition, flavor and speed of preparation. For the microwave we can focus on the tradeoff between flavor and speed. Even before the household microwave oven was introduced there were many alternatives where people made a similar tradeoff; for example, cake mixes versus cakes made from scratch or TV dinners versus home cooked meals. Looking at historical sales figures for these alternatives could have given a clue that people would be willing to pay a premium for faster preparation, not only paying more money but also to some degree sacrificing the taste value driver.

A value driver combines a customer desire with a product solution, which is a prerequisite for a transaction. Besides that sales are also determined by other key variables such as the customers' budget constraints. A given market has typically a small number of key variables (value drivers *and* constraint variables). If we use these key variables as the principal axis defining a multidimensional space, then we can use that space to show the locations of both product solutions and customer wishes (within a given market). The result becomes a map; here called an *utilityscape*, and it can be used to show how sales volumes relate to the key variables. This chapter will explain utilityscapes from the perspective of products, one customer, and aggregate sales.

Product Positions

A product or service provides the customer with different types of basic utility through the value drivers. For example, most jackets have two value variables and one constraint variable of importance to the person wearing it: providing warmth, contributing to the social image of the user by making a fashion statement and be subject to a budget constraint. For the sake of simplicity we will here focus on the two value drivers.[42] Some jackets provide mostly warmth and little fashion, some provide quite a bit of both, and so on. In that way the two value drivers "warmth" and "fashion" define a two-dimensional utilityscape (Figure 10).

The warmth and fashion dimensions are fundamentally different. Warmth can be quantified in terms of insulating properties (R-values as used in the rating of construction materials) and while there may be different features all contributing to keeping warm, we can calculate an aggregate score where more means warmer. The fashion aspect differs; it is a matter of matching more or less into any one of a number of different types of fashion (business causal, skiing, gothic, …). While we can list all of these different types of fashion along an axis of a diagram, one cannot necessarily say that one is more than another. But that does not make the chart less useful.

Any given jacket will plot somewhere in this space depending on how it scores in each dimension. And as the jacket ages it may travel through the utilityscape, if it loses its insulating capabilities or goes out of fashion; however, for now let us just focus on new jackets.

Suppliers bundle value drivers when they design their products, so we cannot get one without the others. For example, you cannot buy a jacket that has no design to it at all. Or a neighbor may offer help, but also spread undesired gossip and play noisy music. If the neighbor moves, all the value drivers disappear—positive *and* negative.

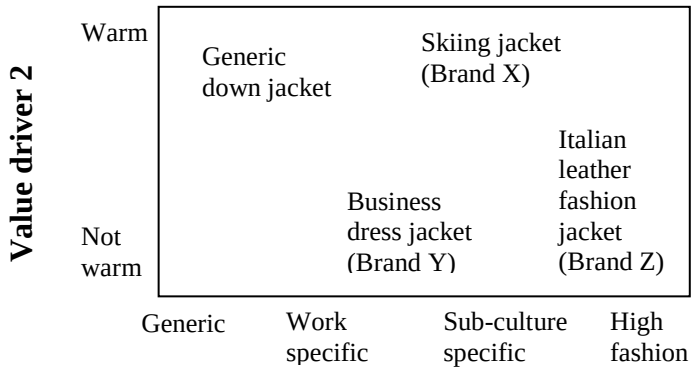


Figure 10. The utilityscape for jackets

Product Value and Risk

How well does a product satisfy the needs of a customer? Most products feature some versatility, which means that they cover a range within the utilityscape. Everything else equal, the larger an area a product covers in the utilityscape, the less the risk is, in particular to the customers who may not be quite sure what their future needs are going to be. Going back to the example of jackets: some jackets have removable inner lining making it possible to change their "warmth value driver" – i.e. the jacket occupies a large space within the utilityscape. Also, some locations within the utilityscape pose fewer risks than others; for example, while a newly married couple will fit in a two-seat sports car, they may opt for buying a larger car with five seats (larger transport value driver). A five-seat car can satisfy the *range* of needs from one to five. So if they transport a couple of friends or, a few years down the road, have children, the car will still meet their needs.

Customer Wishes

Customers usually don't write a detailed list of specs and then start shopping for the solution which most closely matches their spec sheet. Rather they identify what they would like to accomplish (value drivers), and then look at what alternative solutions the market place offers in that general area – subject to their constraints. In that way the customers are willing to consider a certain limited range of solutions for each key variable. This range reflects that customer demand is inherently uncertain in nature, but there are bounds to that uncertainty. In theory we could describe the customer in terms of an acceptable range for each key variable, and tradeoffs he/she is willing to do between different variables. This could be a viable approach in analyzing customer survey data, but outside the scope of this chapter.

The axis in a utilityscape should not only include what is feasible today, but extend as far out as anyone's dreams go, i.e. it is healthy to see the desires which are not yet satisfied by any product, but customers may be dreaming about.

Customer Value and Risk

Products are not stand-alone items. People own a portfolio of products that as a whole aims at satisfying their broad range of needs. Every product does not need to satisfy every need, but the overall portfolio should most of the time—and when it cannot, there should be other solutions

easily available. Customers cannot be viewed as stand-alone nodes: they seek to complement what is missing in their value net, e.g., a guy has a boat, and his friend buys a pair of water skis, complementing the boat. One way to look at the value of a product is to look at the total value of the value net with and without the product in question inserted.

Each customer is not defined by a specific point but by a density distribution within the utilityscape—for a variety of reasons:

1. Customers do not necessarily mathematically define what is better or worse.[43]
2. Customers willingly trade off one variable for another (e.g., more of one value driver for another). This reflects the elasticity of demand for each customer.

Therefore, in the utilityscape a customer represents a point with a distribution diminishing as it moves further out in the different dimensions. There are often clear preferences for certain combinations of values, and tradeoffs between these.

Aggregate Sales

If we knew what key variable ranges are acceptable to each customer, and we know the position of each product, we could calculate a theoretical demand map. However, going back to the example of the jackets, some customers cannot articulate what tradeoffs they are willing to make until they are trying on the different jackets in the store and have to make a payment with *their* money. Customers usually don't dream up their ideal jacket in a vacuum, and then go out to seek the best match. They look around, get influenced by what they see, react to it and iteratively zoom in on the best available option. Therefore, the products available influence the demand, and there is no true independently defined "base demand." However, it can in some circumstances be useful to calibrate some hypothetical demand functions based on the current demand.

Customers optimize mixed portfolios, not just monetary profits. Buying a jacket represents a tradeoff between warmth, fashion and price. The location within the utilityscape reflects a particular customer's relative importance of the different key variables that define the dimensions of the utilityscape. If we take historical sales data and tally up how many customers select different key variable combinations then we can generate a utilityscape. The utilityscape becomes a map of the portfolios actually selected by the customers.[44] That does not tell us what range of options they were willing to consider but what solution they actually settled on and actually were willing to spend their money on (Figure 11). The map shown is a made-up illustration; however, these types of maps can be based on historical sales figures and can be used as a basis for estimating sales volume, as shown in the case study (p. 80).

Marketing is there to influence customers as to the location in the utilityscape they choose to settle in, and a utilityscape based on historical demands will therefore in part reflect past successes and failures of marketing. A good marketer motivates customers to make purchases by helping them relate to the key variables that define the axis in the utilityscape.

The historical data used to create a utilityscape could be for a specific geographic region or for a specific age group of customers, and that will define what market the utilityscape is applicable to. It is therefore reasonable to develop a series of utilityscapes, one for each of the markets under consideration.

While conventional customer segmentation in marketing is based on customer characteristics and product segmentation is based on product characteristics, segmentation based on the utilityscape is based on key variables, thereby combining the two. At first the difference may

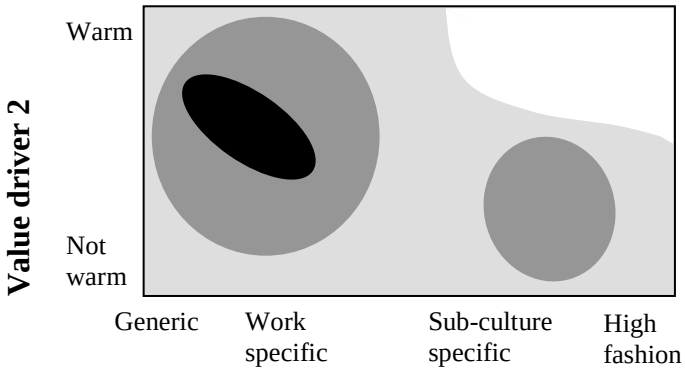


Figure 11. The utilityscape for jackets; darker areas indicate higher demand[45]

seem insignificant; however, the utilityscape brings products and customers into one diagram, which is exactly the combination that forms the basis for sales.

The success of many products depends on the availability of complementary products; for example, few computers will be sold if there is no software to buy. The utilityscape provides a graphical representation of the effect of *combining* different basic dimensions within a single product, or group of products; so computers and software can be treated within one utilityscape. If computing power (speed, memory) is represented on one axis, and software categories (different clusters, just like fashion) on the other axis, then we can map the interdependencies of these two in terms of market opportunities. We can, for example, expect that image processing software, which traditionally is data-intensive, will find most of its market in conjunction with powerful computers, while word processing can be sold across the board. Based on these concepts we can analyze product portfolios, and the effect of adding or removing one product (including service, or an auxiliary product) to or from a portfolio of products.

The utilityscape is a map that shows us the total market for segments characterized by a certain range in each of the key variables, not the sales volume of a specific product. If there is a market monopoly, the two are the same, but normally there are multiple products all competing for the same part of a utilityscape. Based on historical sales data it is normally possible to estimate how the sales, within a given part of the utilityscape, will be distributed between the different products indirectly in competition with each other.

The concepts here are formulated based on a consumer market with a large number of customers and often a significant number of suppliers. If it is a commercial or industrial market with just a few customers, we can still use the same method, but we may have the luxury of evaluating each customer and considering their possible future changes in purchase patterns. Of course, if the number of customers is low, then the estimates will inherently suffer from statistical uncertainty.

Constratint-scapes

Customers do not buy if there is no product affordable to them through the distribution channel(s) they shop (Figure 12).[46]

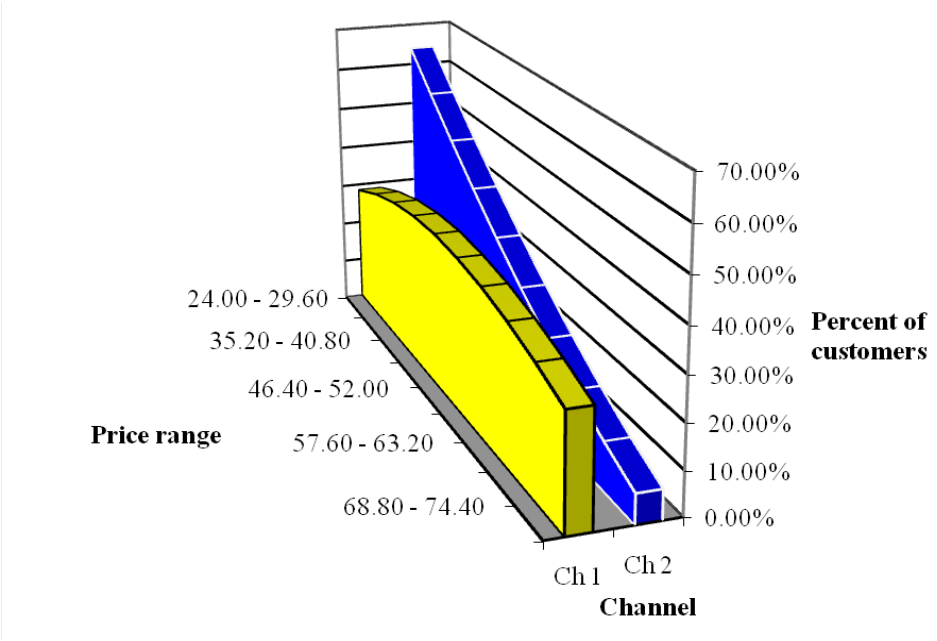


Figure 12. Constraint diagram showing the customers willingness to pay and which channels they shop. Some customers shop both channels and are shown both places.

Figure 12 is almost like an utilityscape, but for constraints. The difference is that in the utilityscape each customer will select one favorite spot, here is shown what percentage of all customers can accept being at a certain location. In other words, in a constraint diagram a customer draws a line how far they are willing to go, and anything on their side of the line is acceptable to them. Therefore a customer can be found in more than location of a constraint diagram.[47] It is here assumed that there is no correlation between what people want and how much they can afford or which channel they shop. However, a four dimensional diagram combining the constraint diagram and a utilityscape can be constructed to take such a correlation into account. Graphically a four dimensional diagram can be challenging to represent on a flat piece of paper. When it comes to problems with many dimensions the type of diagram shown in Figure 13 can be helpful.

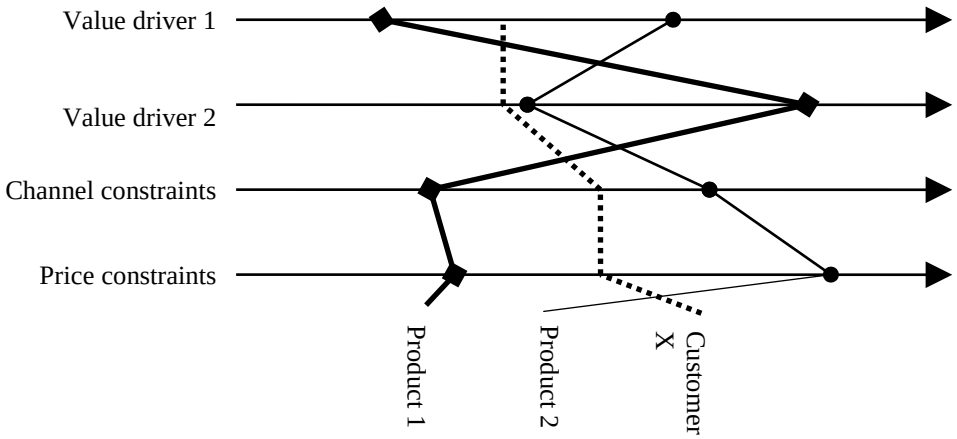


Figure 13. Key variable diagram

Dynamic Utilityscapes

The adoption rate of a new product relates in part to the customer profit, which in turn depends on value to the customer, risk, market power and, the pricing decision factor. The adoption rate can be positive or negative; negative if the item is going out of use. We can use the utilityscape as a tool for analyzing such changes in the market. The first customers who adopt a new technology will gravitate in specific areas of the utilityscape, depending on which dimension of the utilityscape the product improves upon. As the product and the market evolves this will, however, change. Depending on the type impact the new product has on the utilityscape we see different changes as discussed in the following.

No Change in the Axis of the Utilityscape

Most new products neither alter the utilityscape they are in nor change the total market size; all they do is capture market share at the expense of existing products. We often see customers willing to travel within the utilityscape when they discover a new product. Sometimes even a new technology replacing an old technology falls in this category, when the "outside box" and the functionality remain the same. Likewise, withdrawing a product from the market will often just alter the sales volumes of the products left. These kinds of changes can be evaluated by analyzing what influenced market shares in the past (an example is provided in the case study at p. 82).

Cost or cost savings to a customer may or may not be a separate dimension in the utilityscape. At any rate, a utilityscape based on the sales volumes for existing products takes into account the current price levels. Often it is found that prices change in a regular manner going across a utilityscape, and that price is one of the factors determining the variations in sales volume from one part of the utilityscape to another. By inserting a product that is priced either below or above what would be expected for the location it occupies in the utilityscape, the sales will be influenced positively or negatively. Based on the price variations among existing products, relative to what is expected, we can estimate how large these gains or losses will be.

It is evident that most markets evolve over the years. Some of these changes result from a net migration of customers from one part of the utilityscape to another. This could for example be a result of changing fashion. But most changes relate back to the position of products in the utilityscape. A products position in a utilityscapes shows how it compares to the other products, and as products and expectations change over time the position of a product in the utilityscape will change, even if the product remains the same. If we keep and keep selling exactly the same product for 25 years meanwhile all the competition regularly enhance their products, then our product will little by little change position in the utilityscape. An example of that is the British Morgan Sports car which remained almost unchanged since the mid 1930's which changed from being a modern sports car to being a niche product with a historical appeal. The rapid rise of gasoline prices in the US around 2008 pushed the large SUVs down to very low scores on the "cost management" dimension making them less attractive to some of the large segments of customers. It is worth noting that the distribution of customers in the utilityscape mostly remained the same AND the products remained unchanged. However, the price changes in one of the complements (gasoline) made some products (SUVs) slide into lower demand regions of the utilityscape.

Stretching of the Utilityscape

This type of change may include the stretching of the current utilityscape, so the new product falls beyond the current offerings as measured on one or more of the value driver dimensions. For

example, an innovation may enhance already existing value drivers or deliver existing value drivers at a lower price, thus stretching the utilityscape in the cost savings dimension (or corresponding constraint variable), and may enable a supplier to capture customers from the competitors, or even increase the overall market size. The customers who are likely to switch to a new part of the utilityscape are the ones who already reside along the frontier defined by the current products. For most value drivers the bulk of the customer population resides within the territory already covered by existing products; however, for a value driver like cost savings the majority of customers are always "frontier" customers. New technologies that can deliver the same performance at a fraction of the cost are therefore often a relatively safe bet when it comes to product innovation.

Even when innovations modify the utilityscape, we often can extract relevant knowledge about the new market from existing products. For example, the amount of material that can be transported by a truck could in older times been hauled by one or more horse wagons, and the cleanliness of nanoparticle based soil-repellant fabric[48] could in older times have been achieved by frequent washing. In order to estimate the sales of a new product we must include a sufficiently broad spectrum of preexisting markets to learn from. For example, a new type of personal transportation can be evaluated if we include demand for alternatives as different as walk, bike, car, bus, train, hitchhiking or airplanes.

The price dimension is often critical in driving utilityscape changes. Take hybrid vehicles as an example. To make matters simple, we can focus on two value drivers (Figure 14): social image of owner and vehicle lifetime savings, calculated as the net present value relative to a similar "conventional" vehicle. When hybrid vehicles were first launched the savings were negative as the hybrid vehicles were priced above what was justified by the fuel savings. However, as fuel prices go up or the cost of a hybrid vehicle goes down savings from driving these vehicles increase. The social dimension represents the desires of people who would like to portray themselves as environmentally conscious, helping to create change for the better in the society and making a statement toward others that they care.

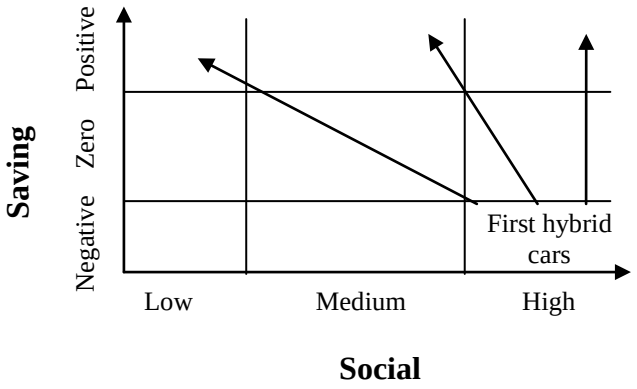


Figure 14. Part of the utilityscape relevant to hybrid vehicles. The arrows indicate possible evolution paths over time

All conventional cars fall, by definition, in the fields with zero saving. The first hybrid vehicles were introduced in the field with "negative saving" and "high social." Evidently the most price sensitive customers will not be early adopters. Even before the first hybrid vehicle was

introduced we could have estimated people's willingness to migrate based on sales volumes and surcharges paid in other markets offering a similar tradeoff; for example, ecological food, private alternative energy installations, "green energy" offered by public utilities at a surcharge and recycling efforts. Another factor: the frequency at which people purchase vehicles, which means that if people only consider a hybrid vehicle when they are going to purchase a new vehicle anyway, then there will be a time lag before the average consumer even considers the option. As the surcharge decreases over time, hybrid vehicles become available as used vehicles and the public perception of these vehicles changes, the adoption rates will gradually change accordingly.

Time Changes in Expectations

Conspicuous consumption has long been a way of gaining prestige.[49] Around 2007 there was a surge in the demand for ultra-expensive food in the New York City – dishes exceeding $1000 per serving.[50] Why this surge in demand for something like that. Could we have expected it? Let us look at an utilityscape with three dimensions:

1. Level of appearance spending, e.g. how many of the car buyers buy cars to make a statement about their wealth and status (e.g. Rolls-Royce Maybach, Bentley) versus need spending (a utilitarian and logical solution).
2. Expectations to durability and lasting quality / value preservation.
3. Different groups of products, such as cars, clothing, jewelry, food, books, electronics, and so on.

Now lets, look at the changes over time. The level of appearance spending has been remaining constant or going up.[51] The expectations to durability has been going down – in part because of quicker obsolescence and reduced prestige from dated products and in part because of a change from repair to replace mentality (driven by lower manufacturing costs and higher service cost). Therefore the natural consequence is that appearance spending is likely to spread from durable to perishable products over time – and that is exactly what we are seeing with the New York "ultra meals".

Creation of a Utilityscape with a New Dimension

A few radical innovations add new dimensions to a utilityscape and result in major value net changes. This may lead to significant conversion of current non-consumers to consumers. These changes often occur when a company focuses on an "insignificant" niche market that over time turns mainstream as the majority of customers initially buying the main product switch,[52] resulting in a restructuring of the entire market and the value net.

In the case of a hybrid vehicle we could assume that all the hybrid-car buyers would have been buying regular cars if they had not been able to get a hybrid.. But what if non-consumers became consumers? What if it had been a personal plane costing less than a car—then many non-aviation-oriented people would adopt the technology. The plane would deliver value drivers found in existing products: transportation as offered by cars and scheduled commercial air traffic and leisure as offered by yachts and ATVs. And we can learn from all of those markets. However, a plane lacks the convenience of a car, in part due to the absence of a nation-wide network of small landing strips coupled with a car rental or loner car system that offers travelers a convenient way to complete their journeys.

Radical innovations usually create new value nets different from existing ones. That can be difficult because value nets normally originate through gradual evolution directed by the decisions by millions of individuals, rather than based on a masterminded blueprint. Companies may influence this process by taking the roles of several nodes and by getting into the business of

supplying complementary products or services. To illustrate how to deal with this problem, we can consider a simple product with only one value driver and a simple value net with only two groups of nodes: "us" and "everybody else." We can now plot this as shown in Figure 15.

It is normally a chicken-and-egg situation: the external contribution does not evolve unless there are enough customers to justify doing so, but customers will not buy in until the external support exists. If a gradual increase in customers occurs as you move in the x or y direction, then the market can be expected to evolve naturally because each of the two groups (core product and complements) will at any given point in time see enough of the other to have an incentive to continue investing in growth. However, if there is no change until a large critical mass has been achieved, it may take huge investments, and be risky. Sometimes the external contribution is the consumption by other users, such as a telephone that only becomes valuable if there is somebody else to call. In that case, gaining critical mass becomes even more challenging because it depends on so many decision makers.

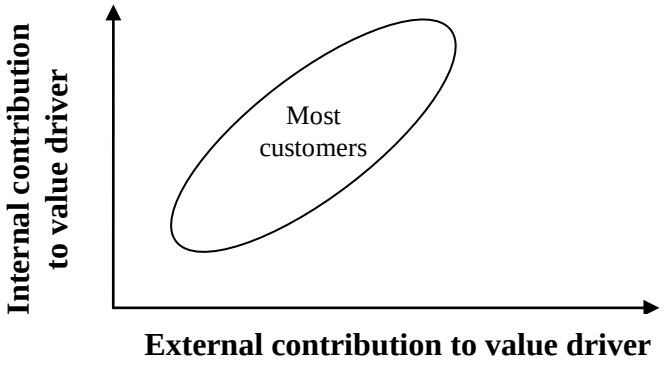


Figure 15. Value driver contributions in a new market

---

41 Question asked by Dr. Richard Shandross (personal communication March 2005).

42 Some jackets provide "rare" value variables as offered by waterproof jackets and reflective safety jackets, however, these are also disregarded in this discussion.

43 This is like a fuzzy membership function.

44 This is parallel to the balanced scorecards (see Robert S. Kaplan & David P. Norton, 1996, *The Balanced Scorecard, Translating Strategy into Action*, Harvard Business School Press, Cambridge, MA, 323 p.)

45 This figure is not based on factual data; it is only intended to illustrate the principles of a utilityscape.

46 The figure shows the percentage of the total potential customers (at a given price level which they can afford) who will purchase depending on which channels the products are available through. The reason that sum of Ch 1 and Ch 2 is more than 100% is that some customers will buy if available in either channel, but they will not purchase additional units if sold though both channels (i.e. Ch 1 and Ch.2 is 100%).

47 Some utilityscape dimensions behave like constraint diagrams

48 Alan Zeichick, 2003, The Fabric of Consumer Reality, *Red Herring*, no. 123, p. 54, March 2003.

49 Thorstein Veblen, 1970 (first published 1899), The Theory of the Leisure Class, An Economic Study of Institutions, Unwin Books, London, 261 p.

50 Rachel Jones, 2006 02 28, A Thousand-dollar ice cream sundae? Why not? Columbia News Service, http://jscms.jrm.columbia.edu/cns/2006-02-28/jones-thousanddollaricecream.

51 At least for product groups like cars.

52 Ed M. Yoklay (of Think Craft Inc.), 2002, Strategies for Speed Dependent Disruptive Business Environments, presentation at the American Chemical Society National Meeting, Boston, MA, 20 Aug. 2002.

Chapter 6
Prices

We need both estimates of price and quantity to evaluate the revenue potential for a new product. The previous chapter discussed sales volume. But how much will the customer be willing to pay? To answer this question we will look further into the following topics:

A. The value to the customer.

B. The risk to the customer.

C. The market power between buyer and seller.

D. The price ceiling.

A. Value to the Customer

A product and service usually provides solutions to a few basic needs, and the value drivers discussed above is a way of expressing those solutions. The value drivers experienced by a customer will limit how much he or she may be willing to pay, and quantifying the value drivers is therefore a good starting point for estimating the market price. Often we can estimate the monetary value of a value driver to a given customer; it could be based on what the customer currently is paying for getting those needs satisfied or how much a solution will save the customer. Companies using value based pricing use these kinds of estimates as the foundation for their prices.

B. Risk to the Customer

Usually a customer decides to buy a product some time prior to harvesting the benefits it provides, thereby introducing some risk as to how much value the customer will actually receive. If I find a tool useful today there is the risk that I will no longer need it in the future; or that it may break in a way so I cannot use it. When we try something we are not familiar with, the risk increases, so an unknown brand or a new supply channel increases the risk. A “low introductory price” offered by some companies is, in part, in response to this increased risk faced by new customers.

Depending on the risk, the customers consciously or unconsciously discount the value, just like we in finance discount the value of stocks, which by nature are risky, based on their beta. We don’t have a beta for a lawnmower but we can look at the probability that it will become useless (for whatever reason) during the next one-year period. Every value driver, positive and negative, is associated with various risks, so we can start by looking at the risks associated with each value driver and then combine them to find the overall risk. Once it’s determined we can discount the value accordingly to achieve a risk discounted value.

What really matters is how the customer perceives risk, because that perception will influence his or hers purchase decisions. When a customer assigns a risk level to a product, he or she often compares it to other products and services. The risk premium is therefore a market-driven phenomenon. For example, the market line and beta in finance reflect the risk level; however, the specific conversion of risk to an actual percentage premium will depend on market forces, so if the entire market becomes more or less risky the majority of investors will follow and accept that

change, while the actual premium is based on how risky the company is relative to other companies. There are two different types of risks: risks associated with the value drivers and risk associated with the value net.

Value Driver Risk

Value drivers reflect the combination of customer's need with a solution to that need. Both need and solution are associated with risks:

1. Product risk. The product may fail or the availability of supplies or services may be discontinued.
2. Customer risk. The customer may no longer need the item, may find a better solution, may no longer be able to afford using the product or may find the side effects incompatible with his or her value net.

In each category there exist foreseeable value drivers and risks, and surprises that may emerge over time. Part of the risk hinges on our inability to predict what the future brings. Even if we cannot pinpoint specific risks, people often have an overall feeling for the level of additional risk and, based on that, they discount the value accordingly. And that holds not only for products, but for any value net exchange; for example, there was an engineer who rated his business contacts on a "flake factor" scale from 1 to 10, reflecting his impression of their integrity, or lack thereof.

Companies have been adding complements specifically designed to manage or reduce risk, although rarely do they quantify the impact these measures have in terms of how much more the customers will be willing to pay. Some examples of complements are:

- Warranties to reduce the risk associated with product failures or poor quality in general.
- Money-back guarantees and free trial samples to reduce the risk of the product not matching the customer's need.
- Customer-help hotlines to reduce the risk of the customer not figuring out how to use the product.
- Free product upgrades to reduce the risk of obsolescence.
- Educational advertisements to help customers identify if a given product suits their needs and wants, and if so, how to buy and use it.
- Industry standards used to ensure compatibility. The risk of buying a generic computer mouse is lower than having a pointing device that only works with one type of computer. Even if the mouse fails, and the original supplier goes out of business, there will be another supplier who can help. This ties into the idea of safety value nets (p. 60).

While these are risk-mitigating tactics, they carry risks of their own. For example, a company may default on the money-back promise or it may take the company a year to fulfill its warranty obligation, leaving the user without the product during that period.

A brand name and a large ad campaign can signal a lower risk to the consumer: a strong company with a good brand name reputation at stake and a budget for a large ad campaign is less likely to default on its promises. In fact, there may be comparable benefits of an ad campaign as a warranty program in terms of ensuring product quality.[53] The boom of franchises is in part based on the risk factor: at a restaurant that belongs to a fast food chain we know what we can and will

get. A similar restaurant that is independently owned and operated could bring us something unexpected. Some customers use the popularity of different stores as a risk gauge, with a popular store perceived as less risky.

Some risks remain outside the control of the seller. That does not mean that the seller should not worry about them. When the customer failed to follow the instructions, burned the product, and does not want to buy another one, it is the customer's fault, but the company has lost a potential repeat customer and must deal with the negative impact that the customer's negative publicity may cause. Therefore, even if it is not our fault, it is still our problem.

We can view the reduced risk as the "core value" of an insurance, and consequently enter the risk (or lack thereof) as a value driver. On the other hand, an insurance policy is only a complementary product to something else; if it is house insurance the value to us is the house, not the insurance. If the insurance costs so much that the homeowner is indifferent to having any, we have: The risk-reduced value of the home with insurance is the same as the risk-reduced value of the home without insurance plus the price of the insurance premium.[54] From this viewpoint it is still useful to look at the risk as a separate entity in the equation rather than treating it as a conventional key variables. Looking at risk-mitigating measures from this perspective opens the possibility of putting a dollar value to investments in real options, safety value nets, a speed culture or innovation capabilities (See p.61).

Value Net Risk

There are several risks associated with the value net. The company may not have the financial or human resources required to deliver as expected. Also, the company may change the business focus in a way so that it loses interest in a customer. In small businesses the company may rely on a few key people, and if something happens to one of those individuals it may mean failure for the entire business or at least discontinuity in the service to some of the customers. There is also risk related to the remainder of the value net: New solutions may come to the market that make the product superfluous or providers of complements may discontinue their supply, making the core product or service useless.

Some value net configurations are more risky than others. One-stop shopping reduces the risk because it is more likely that everything bought will work together. For example, software that comes preloaded on the computer usually works, while software bought separately may not. A single-source supplier will increase the risk because if it goes out of business it can cause a major interruption in supplies. That is the reason why some companies[55] require a minimum of two independent sources for each component.

In reality the risks may not be as large as they appear to be from looking at risk of the individual nodes and value drivers. If the supplier is part of a network of companies it reduces the risk to the customer, because if the supplier fails, other companies in that network may be able to step in and provide assistance, e.g., a value-added reseller may assist the customer to avoid the loss of future sales, or if the product turns out to be useless to the buyer it might be possible to sell it used. Or there may be tools to reduce certain risks, for example futures markets and long-term delivery contracts may reduce the risk of future price fluctuations.

C. Market Power

The market power is a measure of the supplier's ability to appropriate value. Usually businesses cannot charge the full risk adjusted value, because they lack the market power to do so. However, the customer's risk adjusted value includes value created not only by the supplier but also by the remainder of the value net surrounding that customer. So in theory it is possible for a business to

charge for value created by others—**if** the business has sufficient market power to do so. Often we encounter businesses that excel at creating value but are poorly positioned to charge for the value they created; some of the failed Internet companies can attest to that. By analyzing the market power balances in the value net we can estimate what fraction of the risk-adjusted value actually can be charged as a selling price. A transaction always involves multiple value flows, for example, a hardware component, a service component and a money component. Each of these flows may go in different directions and in varying degrees contribute to the overall aggregate market power. For example, in the case of a computer system the customer may posses technical resources in house that can provide the service component at a much lower price, therefore leaving the supplier with little market power in that area.

Competition depends in part on the proximity to other products in the utilityscape and the price differential to those other products. A directly competing product is a product that is "close" to another product in terms of value, cost, risk and market power. There are many ways of acquiring and managing market power. Uniqueness in any of the value drivers or risk-reducing factors can be a basis for a monopoly. A trusted brand name is unique to one supplier and therefore a form of monopoly. Exclusive agreements with key suppliers of complements (complementary products, distributors or service providers) also give market power; however, if the market power depends on these organizations, they themselves will be in a good position to claim their stake of the value created for the customer.

Table 1. Summary of market power factors

	Internal to node	**External to node**
Supply	• Own supply • Supplier monopolistic power • Other barriers to entry • Knowledge • Emotions	• Market supply • Competitors and alternative offerings • Market structure (company size distribution)
Inter-action	• Negotiation skills	• Legal restrictions favoring either supplier or customer • Total market size
Demand	• Customer demand • How badly the customer needs the product • Switching cost • Knowledge • Emotions	• Market demand • Buyer consortia

The more a customer *needs* a product from a specific supplier, the more market power that supplier has. So competition reduces market power, because it creates alternatives for the buyer. There are three different types of competition:

- Direct competition from fairly similar products, e.g., one mid-size sedan model versus another.
- Indirect competition from products that solve related problems for the customers in other ways, e.g., a car versus public transportation. Sectors do compete; for example, if the public pension system deteriorates then people will look for alternative sources of retirement income, which in turn increases the demand for pension funds, mutual funds and stocks, reducing the market power of the buyers of those assets.

- Competition from unrelated products; e.g., buying a cottage instead of a car. While the car and the cottage have little to do with each other, they may both compete for the same money. The customer's budget constraints may significantly reduce the market power of the supplier. One "competitor" we always need to keep in mind is the consumer who does not want anything at all; after all, we can do entirely without the majority of products and services offered today.

There is no clear boundary between one group and the next; however, if I had my eyes set on a car, then cottages must be priced low compared to cars, in order for me to consider them, while if it is one car versus another then even small price differences may tip my decision one way or another.

A supplier may depend on other companies to deliver complementary offerings, and these suppliers claim their own share of the market power. In the case of computers and software suppliers, the complement supplier (the software) often exerts more market power than the core product (computer) supplier. That has resulted in an average profit margin that is 2.4 times higher in the computer software and service industry than in the computer hardware industry.[56] As the customer considers the value of the entire bundle, and that value is limited, it often ends up being a market power battle between the various complement suppliers.

In conventional microeconomics the equilibrium price is defined based on supply and demand, and in most cases the competition is also the most important factor limiting market power and influencing the market price. A large group of customers who desire a product in limited supply will give market power to the supplier, thereby allowing a higher price. Competitors to the supplier give the customers market power by increasing the overall supply and by offering alternatives to the customers.

Monopolies and cartels can, through the lack of competition, gain significant market power. Controlling a standard is one way to create a natural monopoly. While a technology-based natural monopoly is an excellent source of market power, it can quickly disappear once a new generation of technology wins the market. Owning a trade secret, a patent or a trademark is another way to gain monopolistic power. Competitors often find ways around these rights, however, allowing them to introduce competitive products resulting in a reduced market power. So market power requires continuous development in order to remain effective.

Many companies and individuals derive income from knowledge associated with market power. The knowledge that has lost its market power becomes a common good that it is hard to turn into profits (e.g. expired patents). However, most of the standard of living we enjoy today is founded on knowledge that was developed in the past, but has lost its market power, and is today not even acknowledged for its value.

Interrelationship Between Parameters

Some product characteristics will influence not only the value, but also the risk and the market power; for example, the brand equity of a well-known car brand can influence:

Value. It can create direct value for the car's user by providing the image that the user is seeking; maybe the user's friends will view the driver in a different way when he/she drives a car of this brand. The value that counts is the value in the eyes of the customer; therefore intangibles, like the way others look at the user, could be important. Of course, not everybody has a positive

connotation of a particular brand name; a name cherished by some might be considered as snobbish or poor by others.

Risk. While a generic car brand will not suffer much from random quality glitches, a name brand could get seriously hurt by that. Therefore, companies cherishing their name brands often monitor the quality more closely, and at the same time the supplier of a major name brand is more likely to stay in business and deliver on its warranty obligations in case something should go wrong than a low-cost supplier that may be fairly ephemeral. Therefore, most customers regard a major name brand as less risky than a less known name brand. Again it is the customer's perception of risk that will influence the price he or she will pay, so whatever the customer's perception is, that is the reality we seek.

Market power. For a particular trademarked name brand there is only one brand owner. For customers who really want a particular brand, the supplier gains significant market power. Again here it is the customer's perception that defines the market reality.

In the computer industry we can see a tradeoff between risk and market power. Some large computer companies[57] require significant financial transparency from their component suppliers to ensure the financial strength required to maintain uninterrupted supply of components. From the computer company's' perspective this reduces the risk because it sees that the component suppliers are in a position to deliver. However, at the same time this reduces the component suppliers' market power because their customer knows more about their business. It is an interesting balance act for the component supplier, how much financial information it is beneficial to reveal.

Price

The price is limited by the *value* to the customer; the more value the higher the price. However, the higher the *risk*, the more this value is discounted. If we had total *market power* we could charge the customer full risk reduced value (market power = 1), while if we have no market power (market power = 0), we can only give the product away. These observations can be summarized in the following conceptual price equation:

$$\text{Price} = \text{h}\,\frac{\text{Value}}{\text{Risk}}\,\text{Market Power}$$

The factor *h* is a pricing decision factor discussed below. This equation can be formally derived as discussed in Appendix 1 (p. 102). The selling price has nothing to do with the cost; however, in a competitive market with competitors with a similar cost structure, new competitors will keep entering the market and drive the market power down until the price is close to cost, at which point no more competitors will want to enter and no further dilution of market power will take place. In that case we see how this model is reduced to the conventional micro economic theory stating that in a competitive market the market price will equal cost.[58] In the case of other factors providing market power, such as ownership of a standard or a patent, this dilution of market power will not take place and higher prices can be charged.

For numerous products and services the market is basically competitive, i.e., cost driven. As consumers we tend to refer back to some sort of generic baseline price. Although that price will

change over time, we can at a given moment say we know "what is a reasonable price." If it was regular gasoline we may as a consumer recognize that some gas stations offer more than the basic product, e.g., it may be a brand name, full service or it may offer one-stop shopping convenience for gas, newspapers and food. Let's say the market has defined the baseline price and we assume we cannot influence it. Then we can look at how we can price our product above or below that baseline price based on how we score in terms of relative value, relative risk managing capabilities and the relative market power we have compared to the generic product sold in a generic store.

$$\textit{The market price is:}\quad \text{Price} = \text{h}\,\frac{\text{Value}}{\text{Risk}}\,\text{Market Power}$$

The pricing decision factor, *h*, reflects how we choose to price the product relative to what the different customers are willing to pay. If we look at one customer, the theoretical price ceiling, or the highest attainable market price, is basically the price that will result in zero customer profit, i.e., the pricing decision factor equals one. If we have a list price, rather than a different price for each customer, then we will have to take a pricing decision that implies that we charge less than some customers are willing to pay, and above that for other customers. We may be setting the price low if we are aiming at gaining market share, establishing a standard or signaling a potential competitor that they should not enter the market space. It is therefore common that the price is set at a level less than the market power is permitting us to do, i.e., the factor *h* is less than one.

Table 2. Examples of proxies used for variables in the price equation

Variable	Proxy
Value	Scores on different value drivers, savings to the customer, enhanced earning potential to the customer.
Risk and risk mitigation	Prices and sales volumes of extended warranty programs. Price volatility during a quarter.[59] Type of good (fashionable, seasonal, or baseline).[60] If the product is a stock then we can use the widely adopted beta for stocks.[61]
Market power	Brand recognition, advertisement, market share, government regulations (e.g., government-granted monopoly), market size/structure, number of suppliers and number of buyers), firm size inequality,[62] buying power, profit margins. If we assume that companies tend to optimize profits, then we can correlate public available profit data (e.g., from annual reports) with the various factors that traditionally tend to increase market power, such as patents, company size versus competitors, market share, and benefits from laws and regulations.

Dynamic Changes in the Price Equation Variables

Value. Radical innovation often involves the extension of existing utilityscapes or the creation of entirely new utilityscapes. That leads to a focus on value creation, and many startups are built around a strong value proposition. It is not uncommon to see businesses that, at the time of funding, aim at offering their customers a value-to-dollar ratio that is one to two orders of magnitude better than the incumbent competitors.[63] Lead users have the highest need, the most involvement and on average the most skills, and are therefore valuating the product the highest. As the audience gets broader, customers with less urgent a need may join the market, causing a

decline in the average value to the customer. However, if the product requires familiarity, complementary products, or a large user base in order to become useful, then the value will increase over time. Many products are perishable because the needs keep changing; for example, old magazines and outdated computers usually fail to meet the value expectations of customers, of course, unless you into collecting historical items.

Risk. A new product from a startup is typically associated with significant risk: neither the company nor the product has a track record and the customers face uncertainty in terms of how to use the product. These risks have been termed liability of newness.[64] Venture capitalists often seek to reduce this uncertainty by bringing experienced entrepreneurs on board early on. Because early adopters often have the highest need, the risk that it will not be useful to them is the lowest. However, customers have yet to gain confidence in the product and the supplier, and develop an understanding of the usage, so from that perspective the risk is highest in the beginning and then ebbs as time passes.

Market power. A startup exploring a radical innovation will usually gain a short period of market monopoly until competitors decrease the market power by bringing competing offerings to the market. Therefore, time to market becomes important. Companies have been exploring many different strategies for maintaining market power, from creating a steady stream of new products to relocating to a central and unique location in the value net. Even in the beginning it may be challenging to claim market power because a new company or a new product may lack brand recognition and there will not be widespread market awareness about the product, thereby limiting the market power. While a new product may offer unique advantages to the customer, it is competing for the same disposable income and the same limited time for consumption as all the other offerings in the marketplace. For a product released two days ago, every potential customer knows that two days ago they lived without that product, and most likely can continue doing so.

A sole supplier's market power will go up over time as the market grows: each customer becomes less important, and the supplier becomes a more important player in the value net relative to its suppliers and companies offering complements; e.g., a publisher of "how-to-use" manuals becomes more interested as the sales volume of the product goes up.

Pricing decision factor. Often the pricing decision factor changes over time depending on the pricing strategy; however, if the market becomes more competitive, the possible range (i.e., the difference between highest price that can be charged and cost) drops, reducing the pricing strategy options.

Marketing. Each of the basic variables in the price equation is addressed by marketing in different ways:

- Value. Marketing can be used for customer education; teaching customers the usefulness of the product or service. This creates a sense of need among the customers or it creates dreams that the customers would like to fulfill. This makes the customer aware of the value that they can obtain through a purchase.
- Risk. In particular if the company, the brand and the product are unknown, customers often like assurances that this is not just a scam, and marketing can do that. Some customers interpret a major marketing campaign as a signal from the seller that "we are in this for the long run," giving the customer confidence.

- Market power. Awareness among customers, such as improved brand recognition or reminders that this product is in the market. Marketing could also support the creation of a brand-based culture shared among the users.

So marketing supports the establishment of value, risk and market power perceptions among customers. As a product moves through its product life cycle, we can expect the marketing to change. For a traditional product the focus may over time be changing from value and risk reduction to awareness, brand recognition and other market power related efforts.

Pricing Strategy

Some businesses focus on one part or another of the price equation, and they may select a different pricing decision factor (*h*), or gradually change these choices over time leading to different pricing strategies. Some extreme pricing strategies include:

Full pricing equation driven strategy: Market Skimming is a strategy that seeks to optimize the profit over time by gradually lowering the price and expanding the market to include more of the reluctant customers. The largest challenge may be that competitors feel invited to join the market during the early phases where prices are high, and subsequently it may be hard to get rid of these competitors. If there is no list price, but customers are quoted individually, then this can be taken one step further by adjusting the quotes according to the value, risk and market power specific to each customer—if we can estimate it.

Strategy for companies lacking market power: Cost Plus is a modest margin above cost typically seen in commodity markets where the market power is weak.

Market power driven strategy: Killer Pricing is explored by companies that want to drive the competition out, and then subsequently enjoy higher market power. During the initial killer phase, market power is taken away from the competition, and during the subsequent harvest phase the higher market power in the absence of the competitors is used to claim higher profits. Alternatively, the killer pricing for one product can be used to earn more on other products, as was the case with the free web-browsers.

Value and pricing decision factor driven strategy: Premium Pricing is used for some high-end products. A pricing decision factor chosen to limit the market size can signal value and add to the customer's perception of exclusivity.

Risk driven strategy: Penetration Pricing is used to establish market confidence. For a new product the customer's risk is high because the product, the company and/or the usage are not well known. Some companies recognize the adverse effect this high risk has, and adjust the price accordingly. Discounts to new customers are trickier. They may make more people try the product, but it sends the message that loyal repeat customers are not appreciated as they have to pay more than the first-time buyers.

Much has been written about pricing strategies for new products.[65] In selecting an optimal quantity-price evolution, consider to what extent the product depends on a large user base to become a valuable product for the customer. A market skimming pricing strategy with a high

initial price that is subsequently gradually lowered may be good for stand-alone products delivering a direct value to the user. For products where the value goes up with the number of users (telephones, Internet), it may be advantageous to grow the market quickly through an initial low price strategy. A low price strategy may also act as a weak barrier, or deterrent, against new competitors. However, growing a low price strategy into a high margin profit generating enterprise can be a challenge; just look at most Internet companies. Identifying what strategy makes the most sense is much easier after the full profit evaluation has been completed, as described in the following chapters.

---

[53] Juergen Noll, 2002, Comparing Quality Signals: Are Warranties Better than Advertisements to Promote Higher Product Quality?, *Social Science Research Network*, Paper ID 320860, code 020817500, 17 p.

[54] If the price of the insurance premium is $P_{premium}$, then this means:

$$\frac{V_{house}}{R_{with\ insurace}} = \frac{V_{house}}{R_{without\ insurace}} + P_{premium}$$

[55] E.g., General Motors.

[56] Standard & Poor, 2001, *Standard & Poor's Analysts' Handbook*, 2001 Annual Edition.

[57] E.g., Dell.

[58] J. L. Willis, 2003, Implications of Structural Changes in the U.S. Economy for Pricing Behavior and Inflation Dynamics, *Economic Review*, First Quarter 2003, pp. 5-27 (www.kc.frb.org).

[59] This was used by Hewlett-Packard in its supply chain management according to Corey Billington (Vice President, Global Procurement Services, HP), 2003, Creating and Leveraging Options in High Technology Supply Chain, INFORMS Conference on OR/MS Practice: Creating Value in the Extended Enterprise, Phoenix, AZ, Conference Proceedings, pp. 402-409.

[60] This has been used by clothing retailers, e.g., Marshall L. Fischer, 2003, Rocket Science Retailing, INFORMS Conference on OR/MS Practice: Creating Value in the Extended Enterprise, Phoenix, AZ, Conference Proceedings, pp. 50-67.

[61] C. J. Campbell, H. B. Kazemi & P. Nanisetty, 1999, Time-Varying Risk and Return in the Bond Market: A Test of a New Equilibrium Pricing Model, *Review of Financial Studies*, vol. 12, no. 3, pp. 631-42; J. Lintner, 1965, The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets, *Review of Economics and Statistics*, vol. 47, pp. 13-27; Robert C. Radcliffe, 1987, *Investment Concepts, Analysis, and Strategy*, 2nd edition, Scott, Foresman and Company, Glenview, IL, 890 p. and W. F. Sharpe, 1964, Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk, *Journal of Finance*, vol. 19, pp. 425-442.

[62] Philippe Barla, 1998, Firm Size Inequality and Market Power, working paper 9714, Université Laval, Québec.

[63] Russ Planitzer from Lazard Technology Partners, 2000, Presentation at the RPI Venture Forum, 4 Oct. 2000.

[64] Dean Shepherd & Mark Shankley, 1998, *New Venture Strategy: Timing, Environmental Uncertainty and Performance*, Sage Publications, Thousand Oaks, CA, 112 p.

[65] Robert J. Dolan & Herman Simon, 1996, *Power Pricing, How Managing Price Transforms the Bottom Line*, The Free Press, New York, 369 p. and Joseph P. Grunenwald & Thomas T. Vernon, 1988, Pricing Decision Making for High-Technology Products and Services, *The Journal of Business & Industrial Marketing*, vol. 3, no. 1, pp. 61-70, Winter 1988.

Chapter 7
Cost

Having discussed what drives revenue for a new product, we still need to look at the cost in order to evaluate the profit potential. Numerous movements in management focused on the cost side of the business, including reengineering, operations research and just-in-time (JIT).[66] Without attempting to add to this wealth of tools, this chapter focuses on providing some structure that can facilitate determining how profits depend on the strategy selected. While written with a manufacturer in mind, the concepts apply equally well to any type of business.

Just like the buyer, the seller exchanges both positive and negative value drivers. The positive ones include typically both money paid by the customer and non-monetary income, such as customer information, and feedback about the products that can lead to higher future sales. The negative value is mostly "cost" in one form or another.

Cost Components

We can look at four different types of cost (Table 3). The center column in Table 3 relates to the cost associated with developing and manufacturing the products; the right column relates to acquiring and supporting customers. If we want to know what products to manufacture, each type of product should be accounted for separately, and if we want to know which customers or groups of customers we want to serve[67] we need to keep them separate in the accounting as well.

Table 3. Examples of the four components of cost

	Internal cost	**Customer related cost**
Fixed cost/upfront investment	R&D, plant and tooling, marketing	Getting a specific customer
Variable cost/volume dependent	Materials, labor	Maintaining and supporting a customer

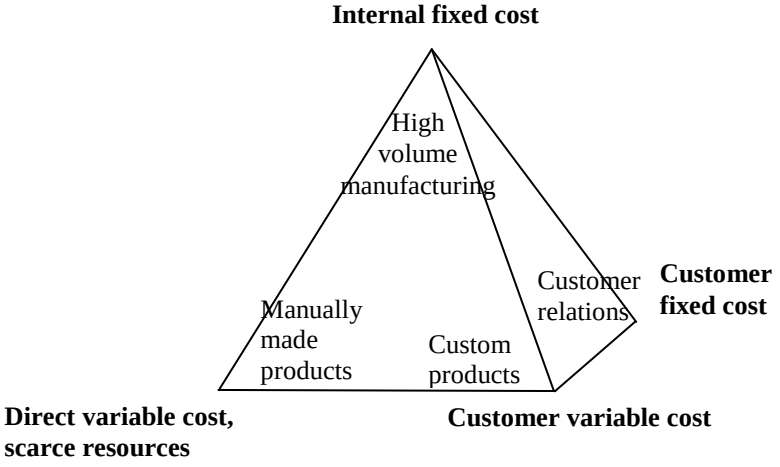


Figure 16. Pyramid diagram illustrating the relative balance between cost components for different types of products

Any product or service will contain some fraction of all four cost components; however, the relative importance varies widely depending on the type of business (Figure 16). Analyzing the impact of different levels of investments in fixed versus variable cost, and product versus customer cost, allows us to better understand different strategic options, including the benefits of higher volume or specific types of target markets.

Customer specific fixed cost is what it costs to acquire the customer in the first place. This includes targeted promotions, demos and presentations. It may be necessary to write contracts, set up accounts and establish a payment mechanism. Customer specific fixed cost creates network competition. When you develop a well functioning network of distributors and customers, the marginal cost of adding one more complementary service or product is much smaller than if you have to build a new network. Why? Each tie in this kind of human network is costly. When a company acquires another company to gain access to their customers we sometimes see a fairly large premium paid; this premium reflects, in part, the investments it would otherwise take to build this customer network up anew.

Customer specific variable cost is what the company needs to spend to maintain a customer. Some software companies found this cost component to be significant. And, some customers will cost more than what they pay to the company.[68] Companies that manufacture small lot sizes, or even a lot-size-of-one, may find a fuzzy line between the customer specific variable cost and the internal (manufacturing) variable cost; however, for a lot-size-of-one it is essential to know what each customer really costs, to avoid losing excessively on "expensive" customers. Some indirect customer specific costs can be hard to quantify. For example, a dissatisfied customer may be "expensive" because he or she spreads bad news about a product.

Internal variable cost is often related to scarce resources, including raw materials and direct labor. The key to this kind of cost is to save. Conventional, or close to perfect, competition as described by Adam Smith[69] often appears in markets where the scarce resource cost is dominant. These markets have low barriers to entry, little economy of scale, and were dominant in pre-industrial times. Over time, value creation evolved from relying on scarce resources such as raw materials and labor to an ever-increasing exploration of knowledge and leverage.

Internal fixed cost includes the costs required for planning the business, gathering market intelligence, developing new company core competencies, developing the products and services, developing the manufacturing processes, acquiring the manufacturing equipment and the facilities, creating a brand image and general marketing. In one way or another, this can be characterized as knowledge stored in people's heads, on paper, in computer files or embodied in equipment—and later used to create the products. When this component constitutes a significant portion of the total cost we may talk about the knowledge economy,[70] but in reality it exists in all industrial economies. Typically, higher knowledge content reduces the need for labor and raw materials, enhances productivity, and reduces the marginal cost. Examples of products dominated by this internal fixed cost include automated manufacturing systems, software and movies.

The cost faced by the customer in many ways resembles the cost faced by a supplier. They have both fixed cost (e.g., surveying the market) and variable cost (e.g., purchasing the item). And they benefit from leverage, e.g., by purchasing products that can be utilized in many different value nets: the same car can be used to transport people, transport goods, plow snow and deliver power for a variety of hydraulic tools.

Leverage

Initial fixed cost investments can lead to high knowledge content and subsequent production characterized by a low marginal cost through leverage of this knowledge. In this book the word leverage is not used, as it traditionally is in finance, for the fraction of long-term debt to total capital; rather, it expresses the ability to create more value with less scarce resources as a result of prior investments in knowledge and tooling embodying such knowledge. There are three different ways of acquiring leverage:

1. Create internally controlled resources, such as conventional IP.
2. Collaborate with external entities. Some companies excel at leveraging on assets (including know-how) that belong to other organizations. Dell Computers is a classical example where its suppliers take over portions of the production and provide extensive leverage based on the high volumes, not only from Dell, but also from the other computer companies supplied by these companies.[71] Another example is StandardMEMS, which when in business, employed a strategy of leverage on the R&D abilities present at a number of external research organizations.
3. Benefit from general trends or waves in society such as fashion. Starting a wave does not mean benefiting from riding it, but riding against the wave can be difficult.

During the agricultural revolution in the Middle Ages and during the industrial revolution, processes were developed. Once a process was developed it was applied over and over again to create more value with a minimum of direct labor input. The leverage of knowledge embedded in manufacturing tools makes it possible to benefit from economy of scale in manufacturing, promoting fewer and larger businesses. Leverage is easier to achieve for certain types of products than for others, and it may require significant upfront investments.

Industrial- and other knowledge-based products are only manufactured when the volume is sufficiently large to justify the initial investments in knowledge, processes and equipment required. Leverage becomes more important as the market increases in terms of number of customers and their ability to purchase. At the onset of the industrial revolution the first target areas were high-volume products such as textiles, food and bricks for limited geographic regions with a large population count. As the economy grew, more products became industrially manufactured, with poor regions staying longer with the pre-industrial production processes. The larger the market the more people will benefit from the intellectual part of a product such as a design, a patent, the content on a CD or the literary content of a book. In recent times new areas have become subject to leverage, such as electronic trade which achieves greater leverage than conventional store-retail trade as fewer employees can serve larger groups of customers. As the world population increases, and in particular as their purchasing power increases, more products and services can economically benefit from high fixed-cost investments. Over time we can expect a product to go through an S-learning curve[72] which basically reflects how the leverage normally increases over time and eventually flattens out.

The importance of leverage and intellectual content for a few different product groups is illustrated in Figure 17. In this figure asset groups are plotted in two dimensions with the intellectual part of the value as a percentage of total value on one axis and leverage on the other axis.

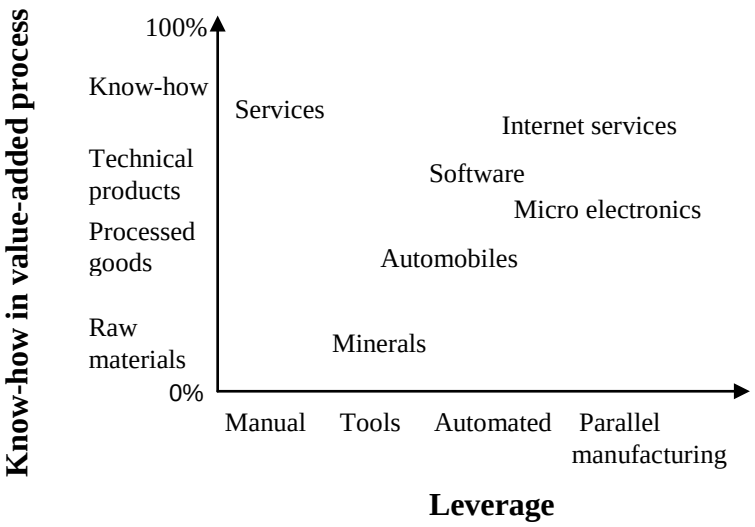


Figure 17. Intellectual content and leverage for different product groups

In the information revolution, products and services with almost no raw material content were created. Economy of scale became now even more important than before, as the incremental cost of additional production approached zero. Increasing returns[73] and hyper competition[74] are often seen in markets where knowledge related cost dominates. Here success depends on extensive economy of scale, and the natural equilibrium state is often a monopoly.

When the same information and pictures are presented to readers of many different newspapers all subscribing to the same news service, the publishers benefit from leverage created by syndication.[75] Syndication is traditionally associated with information intensive products; however, know-how embedded in manufacturing tools or products manufactured for many companies could just as well be the basis. The increase in virtual companies and strategic alliances[76] has opened new possibilities for syndication in manufacturing. Likewise, manufacturing process license agreements and franchises offer opportunities in this area.

The shortening of product life cycles and customization of products both reduce the leverage, i.e., less products shipped for a given initial investment in R&D and tooling. On the other hand this is counteracted by modularity, flexible automation and products that can be used in more than one value net. Modularity consists of basic building blocks that can be used in numerous products, like the CD read head of a CD player that can go into any type CD drive, CD player or, in a slightly modified form, DVD player. Flexible automation aims at reducing the needs for product specific investments in tooling, so the assembly line can be rearranged and reconfigured to produce a different product in a short period of time while maintaining the leverage of a fully automated production line.[77]

A good organization is the human counterpart of a good manufacturing process: the organization induces knowledge and structure that enhance the combined value output from each of the individuals in the organization. Organizations are designed to create efficiency in the delivery of value to the customers—or at least they should be designed in that manner. Inefficient bureaucracies survive too often due to benefits from the other areas such as economy of scale in manufacturing.

Time Changes in Cost

Most startups and new products are facing a steep learning curve, and it can be difficult for them to avoid high costs initially. The cost per unit often decreases as we go down the learning curve; however, as the market becomes more competitive, keeping the cost low becomes increasingly important. Fixed cost is not quite constant, as high volumes will require more expensive manufacturing facilities, but within certain bounds it is fixed. The customer specific cost may go either way over time. In general, late adopters need more support and more selling efforts; however, at that stage the user friendliness of the product has been improved and more supporting products are available making it easier for the supplier. In competitive markets the cost benefits associated with learning are translated into a reduced market price. For example, for solar cells the learning curve is reflected in steadily decreasing market prices (Figure 18).

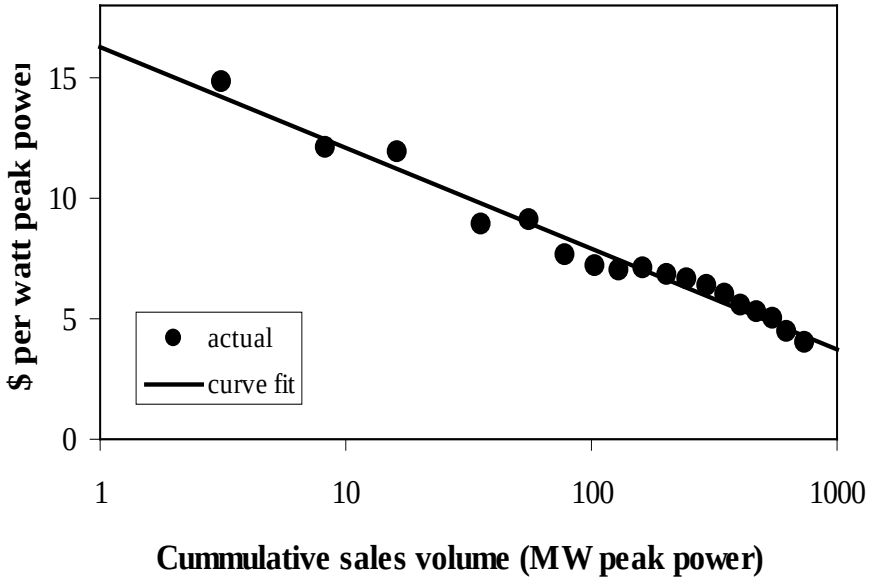


Figure 18. Price to the end user ($/W peak power) for solar cells (photovoltaic) as it decreases with increasing volume[78]

---

66 William L. Ducan, Luftig & Warren International, 1995, *Total Quality, Key Terms and Concepts*, American Management Association, New York, NY, 187 p.

67 Benson P. Shapiro, V. Kasturi Rangan, Rowland T. Moriarty & Elliot B. Ross, 1987, Managing customers for profits (not just sales), *Harvard Business Review*, vol. 65, no. 5, pp. 101-108, September-October 1987.

68 Robert S. Kaplan, 1989, Management Accounting for Advanced Technological Environments, *Science*, vol. 245, no. 4920, pp. 819-823, 25 Aug. 1989.

69 Adam Smith, 1776, *The Wealth of Nations*; edited and annotated by Cannan, Edwin, 1994; introduction by Alan B. Krueger, 2003, Bantam Dell, Random House, Inc., New York, 1231 p.

70 L. C. Thurow, 1999, *Building Wealth, The New Rules for Individuals, Companies, and Nations in a Knowledge-Based Economy*, Harper Collins, New York, 301 p.

71 D. Kirkpatrick, 1997, Now Everyone in PCs Wants to Be Like Mike, *Fortune*, vol. 136, Issue 5, pp. 91-92, 8 Sept. 1997 and G. McWilliams, 1997, Whirlwind on the Web, *Business Week*, issue 3521, pp. 132-136, 7 April 1997.

72 P. Conley, 1970, Experience curves as a planning tool, *IEEE Spectrum*, vol. 7, no. 6, pp. 63-68, June 1970; R. N. Foster, 1986, *Innovation. The Attacker's Advantage*, Summit Books, New York, 316 p. and B. C. Twiss, 1980, *Managing technological innovation*, Longman, New York, 239 p.

[73] W. Brian Arthur, 1996, Increasing Returns and the New World of Business, *Harvard Business Review*, vol. 74, no. 4, pp. 100-109, July- Aug. 1996.

[74] Richard A. D'Aveni, with Robert Gunther, 1994, *Hypercompetition: Managing the Dynamics of Strategic Maneuvering*, The Free Press, New York, 421 p.

[75] K. Werbach, 2000, Syndication. The Emerging Model for Business in the Internet Era, *Harvard Business Review*, vol. 78, no. 3, pp. 84-93, May-June 2000.

[76] J. A. Byrne, R. Brandt, & O. Port, 1993, The Virtual Corporation, *Business Week*, Issue 3304, pp. 98-102, 8 Feb. 1993.

[77] An example of such as system is the AssemblyFlex system from DT Industries.

[78] The graph is based on data from A. Shah, P. Torres, R. Tscharner, N. Wyrsch & H. Keppner, 1999, Photovoltaic Technology: The Case for Thin-film Solar Cells, *Science*, 30 July 1999, vol. 285, pp. 692-698. The line drawn represents the relationship Price = 16.31-4.19*log(quantity sold). This data does not include the later price increases due to raw material shortages.

Chapter 8
Profit-Loss Estimate

Looking at one customer, Figure 19 illustrates how value, risk, market power and cost fit together conceptually. The size of the outer circle represents the total value to the user. By subtracting the risk, we obtain a smaller circle that represents the risk-discounted value. By identifying the market power we can further scale this circle down to a smaller circle that represents the maximum price we can charge the customer. Starting at the other end we can estimate cost. The difference between the total cost circle and the maximum price circle leaves us with a ring, the thickness of which represents the range of feasible profits. Depending on the pricing decision we will capture more or less of that profit. The profit that is not captured by the seller could be considered the profit for the customer. That is the difference between what the customer would have been willing to pay and what was actually paid, shown as money left on the table (mlt) in the figure. There is a loss, if the cost ring is larger than price ring.

In going from one customer to an entire market we have the overall profit given by:

$$Profit = Price * Volume - Cost$$

The price was discussed in Chapter 6, the volume in Chapter 5 and the cost in Chapter 7. In business-to-business sales, we may know enough about the individual customers to be able to understand the entire value equation and we may be giving individual quotes, thereby allowing for customized pricing decisions. In the consumer markets the number of customers is much higher, our knowledge about the individual customers will be less and other measures are needed to evaluate how price influences volume.

If the utilityscape has one axis describing cost-efficiency to the end user, then any change in price will directly influence the product's position in the utilityscape. As the utilityscape is a map of product popularity, a new position gives us an estimate of how that will influence sales up or down (Figure 20). One of the case studies (Chapters 12-13) later in the book goes a step further in looking at the market share among products all occupying a certain region of the utilityscape and showing how price and other factors influence that market share, total volume and how they can be used to estimate elasticity of demand. In that case study the estimates are based on historical data, but could alternatively be based on surveys of different customer segments.

An alternative approach takes its starting point in the demand curve in conventional microeconomics. It shows how different customers will value a given offering and we can adapt that to the present situation. As the price goes down we should expect more customers to make purchases and/or each of them to make more purchases. However, the marginal value of each additional purchase (by the same or another customer) will likely diminish (Figure 21).

Likewise the discounted value (per unit) will be diminishing, and it will likely diminish faster than the value because the risk for the most hesitant customers will be higher—they may, for example, not be sure that this product will meet their needs at all. Again, when we take market power into account we can expect an even steeper line, because the most hesitant customers will be considering the widest range of alternative product/services. These are the ones who most likely will be able to do without this product at all. The cost curve in Figure 21 is drawn so it approaches the fixed cost at low volumes and asymptotically approaches the variable cost at high volumes. The hatched area is the region that can yield a profit, and the vertical distance between

the total cost curve and the maximum price, taking market power into account, shows the maximum potential profit per unit. The maximum total profit is given by multiplying this by the volume.

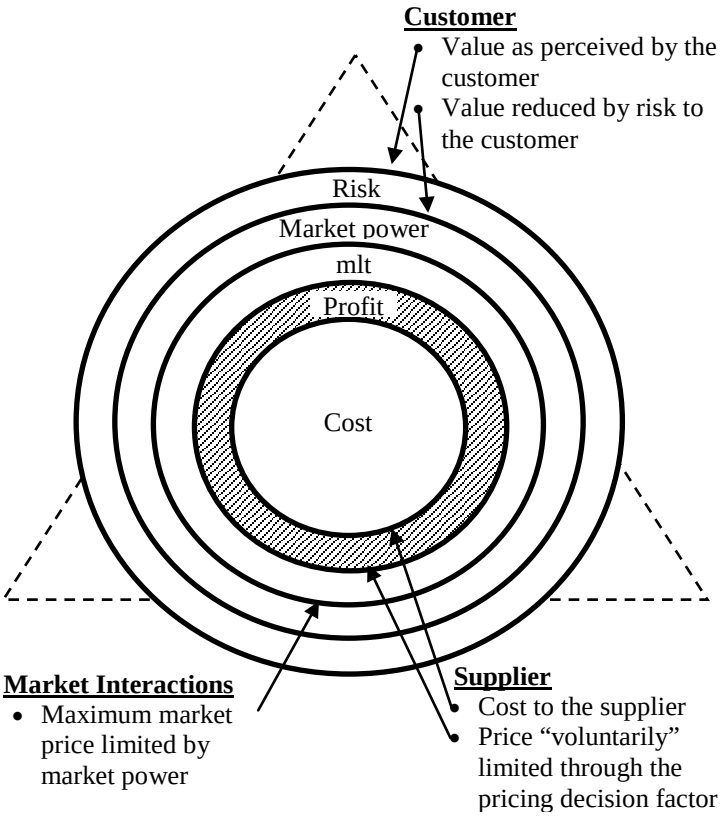


Figure 19. Profit or loss to seller. The area of the cross-hatched ring represents profit. "mlt" is money left on the table. The outermost two rings are determined by the buyer, the innermost two rings are determined by the seller and the center ring is determined by the market interactions. The triangle in the background illustrates these three main forces: buyer, seller and market.

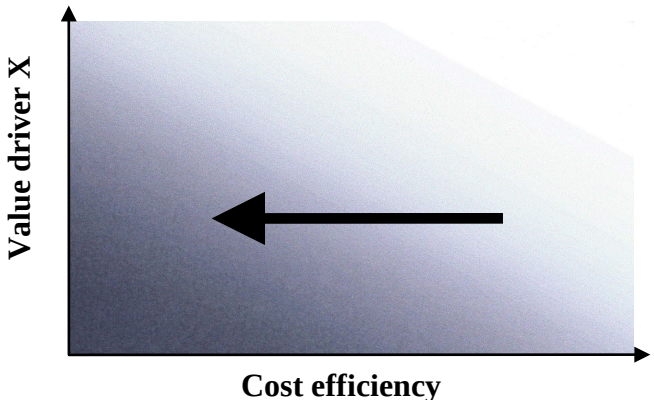


Figure 20. Simplified utilityscape, with areas of higher demand in darker colors; the arrow shows the effect of lowering the price

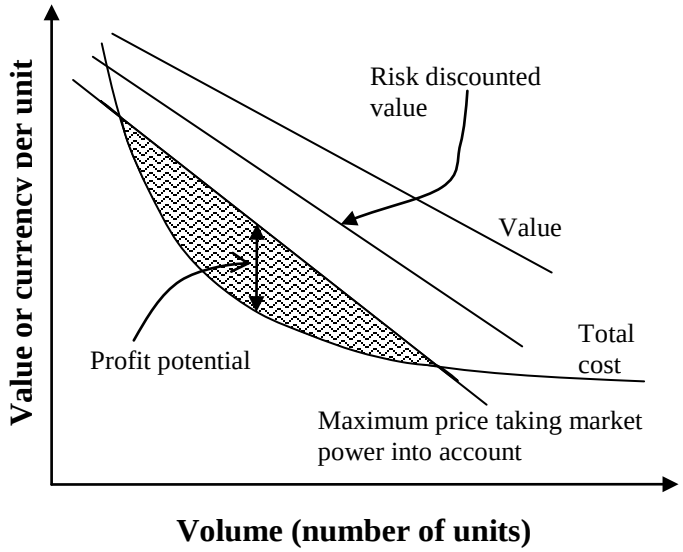


Figure 21. Aggregate value diagram

In practice, drawing these lines (which most likely are non-linear curves) can be done by surveying representative customers from the different customers segments, starting with the pioneers and early adopters and finishing with the late majority.[79] The quantity on the x-axis is the actual volume that can be expected to be sold, taking into account the likely purchase decisions (or probability of a purchase) by different groups of customers and the number of customers in each group.

Figure 22 summarizes the combined effect of the typical changes discussed here for the different phases of the life cycle. The graph does not represent a sufficiently long time span to reach an ideal competitive situation where marginal cost is approximately equal to the selling price—most markets never reach that stage.

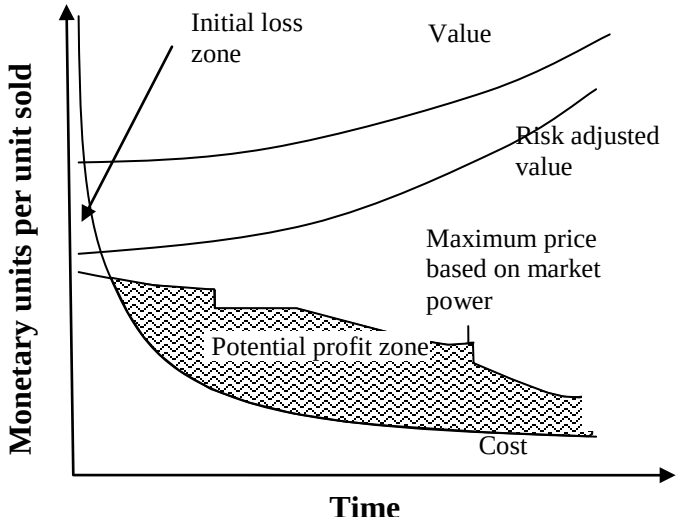


Figure 22. Typical value, price, cost and profit evolution. The abrupt vertical offsets along the profit zone reflect introduction of competitive products

[79] Geoffrey A. Moore, 1995, *Crossing the Chasm*, HarperBusiness, New York, 256 p.

Chapter 9
Innovation

Innovation by the human community has been shaping history ever science the Stone Age. It has been pointed out as a lasting competitive advantage[80] and it is clearly a way to create value. If innovation can take place fast enough it can be used to overcome unforeseen changes in the market. Innovation is not only focused on product development, but just as much on creating new business strategies and new value nets (Figure 23).

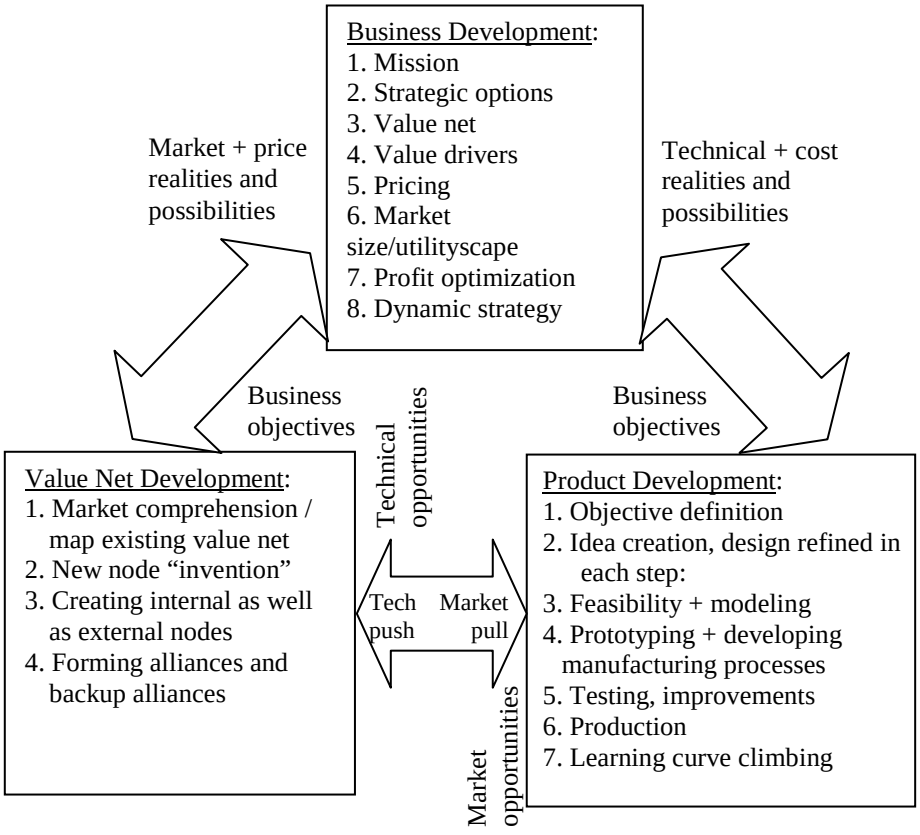


Figure 23. Bringing a new product to the market. Innovation takes place at the business, product and market side. This chapter focuses on steps 2 and 3 (idea creation and initial evaluation) in each of those three areas.

Innovation has become one of the big buzz words in twenty-first century business and there are today many methods that aim at turning innovation and new product development into a predictable science. Creating ideas at random and hope that the customers will be excited about them is risky and often costly business. Having an innovation factory where only one of every million projects fail to become a huge market success is utopia. We are all somewhere between

these two extremes - but where? And how much better could we do? The three basic steps of (1) defining the problem, (2) create ideas, and (3) go through the initial screening of the ideas, are discussed in this chapter. A business success requires the combination of:

1. Directing the innovation process in a way so that the ideas as much as possible offers feasible solutions to the customers needs and
2. Evaluating the ideas repeated times, with a willingness to discard suboptimal ideas.

Defining the Problem

"Go and create something great" is often too vague to get the thoughts going in a fruitful direction – so bringing a market oriented starting point on the table may help. Here is a list of questions taking that approach:

- Some companies find that being at the customer's command is not enough, because most clients lack the knowledge and imagination to go far beyond the current generation of technology. Better results can be obtained by first observing the client's behavior and really comprehending the client's needs and then proceeding to be creative in developing a new product.[81] Which jobs need to be accomplished (the value drivers)? Which areas do we need to improve upon?
- Look at gaps in the utilityscapes. Where are the underserved market opportunities? Including cost to solve problems.
- What are the customers asking for?
- Look at trends – what can you expect next? where should we be in 5 years? how can we achieve that?
- Imagine that you could do magic – what would you do? In other words, forget all the limitations imposed by what is possible today, what would you really like to do?[82]
- Imagine that our product was free – how would you use it?
- Imagine that we had unlimited resources – what would you like to do?
- Imagine that you were the competition – how would you beat us?
- Imagine that the competition did what you are planning on doing – what would you do to counteract it?
- Imagine that the project had already failed – why do you think it did?[83] And how could we have avoided that?
- Imagine that you only had half the resources – what would you do (i.e. what is the most important?)

Innovation implies a change over time (i.e. a time derivative). Most of us tend to think of (1) what we have now and (2) what we will have when we are done – as two discrete stages of existence. An alternative would be to think in terms of processes – how can we create processes that keeps moving us in the desired direction. In that way there will never be a finite end state, rather an ever changing situation. Inventing an "end stage" or a "process" is often very different, but what will serve the business best?

Realizing and verbalizing the problem is half of what it takes to find a solution

The Innovators

Here is an incomplete list of sources of innovations:

Employees. Foster an internal innovation culture, make sure that people with different backgrounds connect. Hire people with ideas and solutions.

Customers. Some great products grew out of customer-generated ideas, customer complaints, surveys mapping the customer's needs or looking at competitors who are not living up to the customer's expectations.[84]

Technologies / research. Another common starting point is for companies to look for suitable usages for a technology they already have or are developing. By finding applications in many different fields it may be possible to achieve high volumes and good leverage in a relatively short period of time.

Innovation harvesting. People proudly put lots of great ideas out in the public domain, and maybe some of them can contribute to the solution we are looking for. Alternatively, networks of external domain experts may have answers and awareness of what will be coming. By knowing what we need and where to look, we may be able to get a head start and a faster development cycle subsequently.[85]

Innovation outsourcing. Have outside contractors sell you ideas, which they either develop or have previously developed elsewhere.[86]

Idea sharing. Looking toward other areas for solutions often proves fruitful. For example, methods developed in medicinal research may be applied to research into superconductors; however, almost any learning process could initiate innovation.[87] What one person says is not exactly what another person hears: when a piece of information is transmitted it moves from one context to another, in which it may take on a new meaning and spur new ideas.

Customer do-it-yourself innovation. The food flavor manufacturer, Bush Boake Allen pioneered in giving the customers tools that allow them to design their own products.[88] Manufacturing continues at large plants serving many clients, to allow for economy of scale and leverage of resources.

Manufacturing by the customer. There is nothing like giving customers the tools they need to create value for themselves. The extreme in customer-driven innovation is to give customers both the tools and the manufacturing capabilities to create their own products. Computer controlled desktop manufacturing is an example of this.[89]

Given the opportunity anybody can innovate

Creating Ideas for Solutions

The more fundamental or disruptive change is sought the harder it is to come up with an idea for a solution. We can here look at three different levels of innovation, with level one being the hardest. Typically an innovation will have to go through the high levels below it before it becomes practical and ready to move on, so a level two innovation will need to go through level three before moving on.

Level 3: Applications of existing methods

Example: An engineer calculating the dimensions of a beam in a house or a farmer feeding the animals using prior experience to provide the right feed stuff in the right quantity. Some of the level 3 tools are:

- Knowledge Management – making existing solutions available in an efficient manner
- Best practice
- Recipes
- Equations and software
- Mechanical and manufacturing tools and know how

Level 2: Recombining existing ideas or applying existing solutions to new problems

Example: When we combine ideas from micrographs of bird bones with knowledge of metallurgy to create high strength – low weight structural members, we are combining existing knowledge to solve a problem. Some techniques to foster level 2 innovation are:

- Find people who has worked in multiple fields, or bringing people together from multiple fields to solve the problem.
- Identify emerging technologies or new enabling technologies, look for existing applications where they can outperform the incumbent technology
- Look for new applications – that have so far not been feasible
- Apply existing technologies to areas they are currently not serving
- At a conceptual level, which other fields have had to solve a similar problem, and how did they do it?

Technically you should not be able to get a patent for a level 2 innovation, however, almost every patent issued falls in this category, when you look at it conceptually.

Enabling technologies can often open for the possibility of leapfrogging in terms of performance, capabilities and/or cost. From an innovation perspective it is often easier said than done because, it takes a lot of insights to fully appreciate the possibilities and limitations of a new enabling technology. This appreciation is here called an enabling mindset. Acquiring that mindset early on in the process is often critical to success. In other words you need that understanding when you conceptually design the product or process, not when the equipment arrives.

Level 1: Conceptually New

Example: Viewing light as a particle rather than as a wave, as previously done, opened the mind to a number of solutions in photonics. However, very few ideas are conceptually new. They will typically extend the utilityscape in one or more dimensions, or even add an entirely new dimension. Some of the level 1 innovation issues are:

- Overcoming the mental limitations imposed by the languages used in external communications, as it tend to influence our perception and description of the world around us and thus the framework in which ideas are formed. People with a visual mind can to some degree overcome the language limitations.
- Shared values and ideas, from fashion to religion. By accepting these ideas we gain membership in communities providing various benefits. However, by getting used to accepting ideas we train ourselves in reducing the questioning and alternative seeking process. Loners or small isolated communities may be in a better position to innovate, e.g. a skunk work team working independent of a large corporation. Just like it has been proposed that small isolated clusters of animals living in marginal areas, are the ones most likely to undergo speciation.[90]
- Experience making our mind force fit problems into solutions, or accept current perceptions of where the boundaries to the impossible is. Newcomers to the field are often better at innovation.

Good ideas are self evident - but only after they have been discovered

Evaluating / Screening Ideas

The following rhetorical questions will make it clear that looking at the product or project out of its context in terms of internal and external value nets may not be very helpful:

- Some ideas stick.[91] Are those the ones you should move forward with? What if they stick among management but not among the customers? Is the project likely to move forward if the idea does not catch on with management?
- Some ideas catch on in the market? But how do we know how well they will do and spread by word of mouth? Marketing will contribute to the creation of messages that customers spread, but were the future marketing campaigns included in the research that was used to decide the chances of success?
- Is a historical success a guarantee for a future success? If steam engines used to dominate the railroads, should that be the next investment?
- If market research shows what the customer really wants, does it matter who delivers it? Does a locomotive company have the same possibilities marketing the next "hit" soft drink as The Coca-Cola Company does?

A commercial project will fail if any one of the following fails:

- Success meeting customer need at the right price
- Success at ensuring that the customer has everything else he/she needs in order to utilize the product, including availability of complementary products
- Success in getting the message out and having access to the customer
- Success in cost management
- Success in making the employees / managers buy-in. A failure could be driven by fear of loosing the job if the project succeeds
- Success in execution, in a timely manner

Most of this book is dedicated to the first of these three items. In general successful innovation is characterized by:

- Changing the whole system for the better. Innovation is only successful if the whole system works. A full system evaluation (the 3C s in Table 4) is needed
- Follows a path that goes through a series of achievable stages: Each stage addresses the resistance to change and investments needed
- The Company is only one out to the 3-Cs (see Table 4), so success is subject to a path that the two other Cs will or have to accept
- Willingness to cut losses, abandon ideas, reduce scope and cost, save time and change established culture

Table 4. The Three Cs.

Customer	Company	Competition / external orgs
Value (does it do the job?)	Value proposition	Alternatives solutions, commoditization of product, competition for attention
Liking it / feeling in tune with it	Brand, positioning	Social context / values plus fashion
Accessible to customer	Distribution channels	Competition for "space" in front of the customer
Affordable, cost management	Pricing	Setting the perception of what is a fair price
Abilities	Customer support	General resources
Bandwidth / interest in "listening"	Marketing	Competing marketing and other information
Perception of the company	Company culture and mission	Norms and expectations

Analytics can reduce the risk at a low cost.
Implementation can positively prove the concept at a high cost.
For larger projects we need both.

System Dynamics

When we introduce an innovation the conventional thinking is that it spreads from the early adapters to the late majority,[92] which from a marketing perspective is very useful. What the more significant innovations also do is alter the system which consists of the consumers, competitors, suppliers, lawmakers, and so on, and that takes much longer. So the introduction of a mobile phone, first spread and then changed the way we view, use and expect mobile communication (oral, visual, text, etc.) to work and it changed the way we live, work and interact with each other. In that way the mobile phone changed the system and these changes affected the customer wishes and expectations. Some of these changes do not show up until long after near-complete adoption of the innovation. In part because they are limited by culture, and do not occur until new generations, who have grown up with the technology, replace the generations of people to whom the technology was introduced as something foreign. Some of the inventions introduced 50 – 150 years ago (from snack food to personalized transportation solutions) are still causing changes in the way people are and live today compared to last year, e.g. percentage of obese people and demand for exercise equipment and gym facilities.

We can look at the market as a network of interconnected entities. If the knowledge of a new product spreads like a virus, then who-know-who and who is exposed to which marketing venues determines the sequence of adaptation among the population. However, the long term market response to the innovation is more similar to the development of immune responses to the virus. It can take a lot longer than contracting the illness to get well again, and it will have a lasting effect on the population (e.g. immune to future attacks of the same virus).

---

[80] Liisa Välikangas, 2003, Managing Innovation as a Corporate Capability, *CEP Magazine*, pp. 64-69, January 2003.

[81] Gary Hamel & C. K. Prahalad, 1991, Corporate Imagination and Expeditionary Marketing, *Harvard Business Review*, vol. 69, no. 4, pp. 81-92, July-August 1991; Theodore Levitt, 1989, *The Marketing Imagination*, The Free Press, a Division of Macmillan, Inc., New York, NY, 238 p.; Justin Martin, 1995, Ignore Your Customer, *Fortune Magazine*, vol. 131, no. 8, pp. 121-126, 1 May 1995. and A. W. Ulwick, 2002, Turn Customer Input into Innovation, *Harvard Business Review*, vol. 80, no. 1, pp. 91-97, January 2002.

[82] Presentation by Andrew McKay, at the Boston Knowledge Management Forum 23 February 2008. The company Attivio used defined their overall strategy by asking what would be great, irrespectively of what is possible today.

[83] Gary Klein, 2007, Performing a Project *Pre*mortem, *Harvard Business Review*, vol. 85, no. 9, pp. 18-19, September 2007.

[84] Gilbert A. Churchill, Jr., 1979, *Marketing Research, Methodological Foundations*, 2nd edition, The Dryden Press, Hinsdale, IL, 668 p.; Philip Kotler, 1988, *Marketing Management, Analysis, Planning, Implementation, and Control*, 6th edition, Prentice Hall, Englewood Cliffs, NJ, 777 p. and A. W. Ulwick, 2002, Turn Customer Input into Innovation. *Harvard Business Review*, vol. 80, no. 1, pp. 91-97, January 2002.

[85] Larry Huston & Nabil Sakkab, 2006, Connect and Develop: Inside Procter & Gamble's New Model for Innovation, *Harvard Business Review*, vol. 84, no. 3, pp. 58-66, March 2006.

[86] See previous reference

[87] Jennifer Ouellette, 1998, Combinatorial Materials Synthesis, *The Industrial Physicist*, vol. 4, no. 4, pp. 24-27, December 1998.

[88] Stefan Thomke & Eric von Hippel, 2002, Customers as Innovators. A New Way to Create Value, *Harvard Business Review*, vol. 80, no. 4, pp. 74-81, April 2002.

[89] J.-M. Breguet & A. Bergander, 2001, Toward the Personal Factory?, pp. 293-303 in B. J. Nelson & J.-M. Breguet (eds.), *Microrobotics and Microassembly III*, *Proceedings of SPIE*, vol. 4568.

[90] E. Mayr cited p. 536 in Stephen Jay Gould, 2002, *The Structure of Evolutionary Theory*, The Belknap press of Harvard University Press, Cambridge MA and London, England, 1433 p.

[91] Chip Heath & Dan Heath, 2007, *Made to Stick, Why Some Ideas Survive and Others Die*, Ransom House, New York, 291 p.

[92] Geoffrey A. Moore, 1995, *Crossing the Chasm*, HarperBusiness, New York, 256 p., Vijay Mahajan, Eitan Muller & Frank Bass, 1990, New Product Diffusion Models in Marketing: A Review and Directions for Research, *Journal of Marketing*, vol. 54, pp. 1-26 and Johan Norton and Frank Bass, 1992, Evolution of Technological Generations: The Law of Capture, *Sloan Management Review*, vol. 33, no. 2, pp. 66-77, Winter 1992.

Chapter 10
Unpredictable Changes

Business is usually about change. Because of never-ending changes in the value nets and the utilityscapes any product will see changes in the way customers perceive value, risk and market power. At the same time, businesses initiate changes by applying new technologies, or by finding new ways of commercially exploring existing technologies. Whether it is a new business, a new product or a new market, its evolution is often driven by predictable changes in price, utilityscape, volume and cost. Understanding the dynamics can help us plan a successful product life or company growth. We may, for example, aim at moving a product gradually from a specialty niche position to being a mass market product as the technology matures and more people adopt it, i.e., going from "early markets" (innovators, early adopters) to "mainstream markets" (early majority, late majority).[93]

Some changes, however, defy prediction—causing a lot of harm and grief—and certainly deserving a chapter of their own. Such changes often originate outside of the organization and could be viewed as market turbulence with an extreme magnitude. Turbulence becomes a source of opportunity if we prepare for it, but failure if we are unprepared. So what does it take to be prepared? No human will ever be able to preview everything: how can we predict the nature of an ingenious invention or a totally new business strategy? While there may not exist any miracle medicine for a company hit by surprise, there certainly are prescriptions to make the company less vulnerable. A few approaches are discussed here.

External Safety Value Nets

Some people have smoke detectors and fire extinguishers in their homes, in case of a small mishap in the kitchen or elsewhere. Those are planned responses to minor local surprises and we use our own tools for them. Big problems, like a major fire, are dealt with by the fire department and the fire insurance. For those circumstances we rely on other entities in the value net outside of our direct control, but entities that we, before the incident, formed ties with, such as signing up for a fire insurance or supporting the formation of a fire department in our community.

What businesses are traditionally poorly equipped to deal with are the unpredictable changes, such as a competitor introducing a "market killer" product that "steels" the entire customer base. The answer may not be a huge R&D department that invents everything before the competition does, just like every household should not invest in their own fire engines. It is more a matter of creating value net links as a safety net that we can rely on to help us quickly, professionally and economically respond to the surprise. Intel took this approach and invested in many microphotonics companies, presumably in the hope that increased bandwidth will increase the demand for high performance microprocessors that can handle the large amounts of information and images transmitted. However, at the same time, if a competitor to Intel should introduce a photonics-based processor, or even an optical computer bus, then Intel's value net partners already own many of the core competencies required to quickly develop a competing product. In that way the value net partners become technology gate keepers serving as the "fire department" of Intel's value net community.

Internal Value Nets

Companies often incorporate a mixture of different organizational structures, but for the sake of argument let's focus on a purely hierarchical structure and a network structure. In the hierarchy, information needed for decision making moves from the bottom up. The top creates goals and then the orders go from the top down. The network, on the other hand, is like a community of collaborating teams or individuals with a shared interest of success and a shared global strategy, but with many different approaches to its tactical implementation. Information and requests for work mostly move laterally among teams. The latter resemble a market economy, and it can be a good way of motivating employees.

While the latter example remains rare in the corporate world, some organizations successfully incorporate aspects of such networks into their organizations. Meyer and Davis[94] show how companies can utilize effective self-organization through first influencing the rules people use in their decision making, and then giving them the freedom to take their own decisions. As an example, they quote how GM allocates paint jobs at one of its plants by having the different paint booths bid on the jobs, bidding low if it appears easy for them to take on the job and high if it requires more costly changeovers. A conventional "single-brain" approach could use an optimization algorithm to allocate the work tasks among the booths, but would most likely fail to account for special situations such as technical issues or employees present but not feeling well, thus being unproductive that day.[95]

Another example is 3M, which allows its engineers to spend 15 percent of their time on any project that interests them, creating a wealth of innovation, and because the business managers must obtain 30 percent of sales from products less than five years old, incentives abound to turn the innovations into sales.[96] These types of networks with decentralized decision making, and decision making at many levels, possess a number of important traits:

More local autonomy makes it necessary that employees master a little broader range of skills than in a conventional hierarchical organization. Specialization offers simultaneous advantages in terms of cost and market power. By being specialized we can become efficient at our specialization, a cornerstone embodied in the idea about labor division in the industrial revolution. While highly specialized companies efficiently explore business opportunities in a stable business and economic environment, a more general skill set allows the group or company to apply the skills in different ways, giving some ability to survive independent of how the environment changes. At the same time diverging opinions, among employees frequently leads to better strategic decisions, as long as the pace can be maintained and the conflicts do not lead into office politics. [97]

Local decision making is one of the facets of a so-called speed culture[98] as execution of plans need not await traditional approvals. A speed culture company will not necessarily be as cost effective as a process driven company; however, it offers quicker response to customer needs and it prepares the organization to react better to sudden changes in the market.

Development work may be performed in parallel rather than sequentially and in duplicate by independent teams, almost like several startups all working to bring a new technology to the market. If one team fails or falls behind schedule, the other teams may be able to deliver. Modular designs can be used to allow for independent development, testing and manufacturing, and to allow for easier and faster redesign, if need be. Some companies choose to pursue several different likely strategies in parallel;[99] for example, Microsoft was at a certain moment developing Windows, DOS, OS/2 and a UNIX-based operating system in parallel.[100] It arguably reduces the tactic focus, but in a highly unpredictable market it may be the only way of maintaining a high chance of success.

Investing in a speed culture, multiple parallel strategies and redundancy in the work may sound like a waste of resources. However, it carries the same value as an insurance policy, or buying financial options as a way of managing uncertainty.[101] Based on the current increase in companies interested in real options, this idea seems to be moving toward mainstream. While each individual strategy in the family can be analyzed by using the methods in this book, they often are interrelated; for example, the success of one strategy precludes the success of the other, or part of the cost associated with the knowledge required for one can be shared by another, so only looking at the whole portfolio at once makes sense.

Each value net structure exhibits a different robustness to change. The hierarchy fails if the top fails; the sequential system fails if any one node fails. The parallel systems can continue working if one node fails, but still the failure of one node will slow down a whole line. The network is the most robust because flow can be redirected around failed nodes with minimum disruption. The hierarchical framework depends on some form of power by the uppermost node(s) to maintain the structure. The collaborative network will only work well if everyone gets enough profit to make it worthwhile to be part of the network.

More on Internal Value Nets

It is claimed that you as a human node in the social network are on average only six nodes away from any other node in the world.[102] If you work in a mid-size company with a stiff hierarchical organization where employees are only allowed to speak to their immediate bosses or their immediate subordinates, then it could easily take six or more contacts to go from the lowest level employee to the CEO or president. This model will explore what the effect of that is.

The model compares two organizations. Each employs 1,111 people. One is hierarchical with four layers where each person is the boss of 10 people in the layer below them, with the exception of the lowest layer, which has no subordinates. All decisions are made in the top and migrate downwards, one layer each time-step. The other organization is a network, where each person interacts with 10 other people at random, and in each time period the interactions are randomly reshuffled.

The market is simulated by a random number generator: in X percent of the time intervals it is a totally random number in the interval 0 to 1 reflecting a disruptive change in the market. In the remaining time steps the market is based on the market in the previous period, plus or minus a random change of less than 0.005, reflecting a small evolutionary change in the market. Each employee in each organization presents a number to the market: The closer the number is to the number demanded by the market, the larger the profit: perfect match gives a profit of 1.

Both organizations learn: In the hierarchical organization each employee selects the number his or her boss had in the previous period, and the CEO in the top selects the number that was optimal in the previous period. In this example it is assumed that no one in the network organization ever has the privilege of knowing what the current market is (as the CEO did); however, a certain percentage (Y) of the workers are innovators, who select random numbers between 0 and 1. All the rest of the workers know how much profit 10 of their coworkers made during the previous period and they select the same number as that one of the 10 coworkers who had the most profit. In that way good ideas from the innovators spread throughout the organization and not-so-good ideas immediately die out.

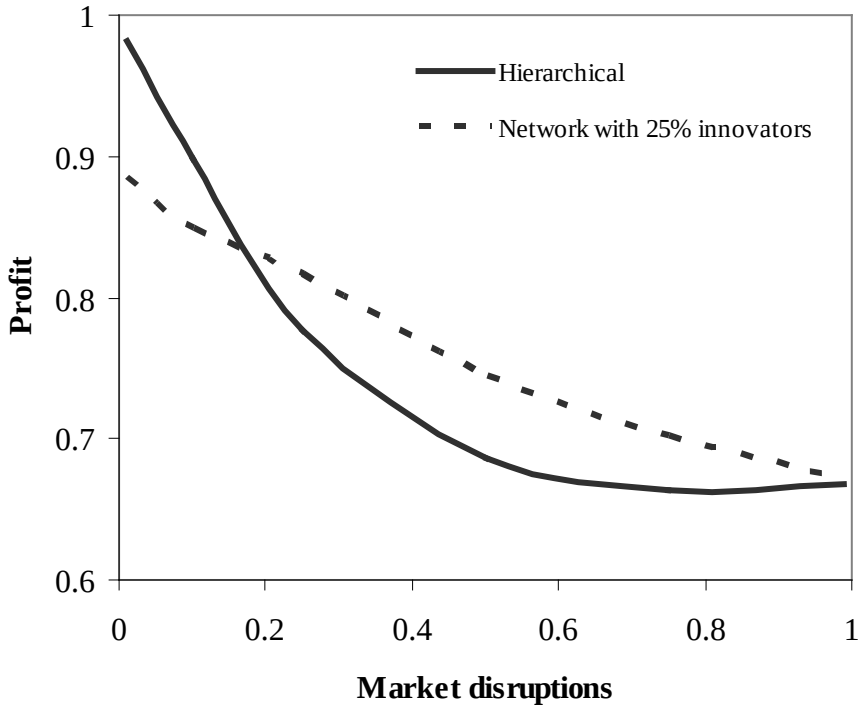


Figure 24. Simulated profits earned by two different types of organizations as a function of the frequency of market disruptions

Figure 24 shows the results from simulations of the profits earned under different market conditions. Not unexpectedly, the hierarchical organization does best under stable conditions, in part because it does not have the overhead of innovators and in this example it benefits from the CEO's perfect knowledge of the current market. However, as the market disruptions become more frequent, the network organization takes the lead, until the market is totally unpredictable (X=1).[103] Figure 24 shows a network organization with 25% innovators, however, the optimal percentage of nodes that need to take an innovator role depends on how turbulent the market is.

Risk

Most people prefer stable to turbulent environments because that facilitates planning and a more optimal utilization of the opportunities at hand. Even a relatively simple thing like a product failure can cause major interruption in our everyday life. Depending on the nature of the risk, we, and our customers, may elect different strategies. One extreme: taking a short-term approach and buying just what we need for now at the lowest possible cost. The other extreme is to take a long-term approach and buy a quality solution that at the same time is sure to meet our changing needs. When customers spend money on an extended warranty instead of on additional features, people are reducing risk at the expense of value. When a two-person household with "conventional" transportation requirements spends the extra money buying and operating a car that seats seven, they reduce the risk of not meeting their transportation needs in some extreme situations.

In making this selection the conventional approach is to look at the return on investment or net present value: what would it be with a higher risk, shorter service life and lower initial cost versus a lower risk, longer service and a higher upfront investment? The cost of capital often leads us to select the investment option with the shorter payback time. The higher the risk, the shorter term is optimal. For example, buying inexpensive cars that depreciate quickly frees up capital and gives us the option to re-evaluate our transportation needs more frequently.

An alternative approach, more in line with the value net and value driver concepts used here, is to look at an investment in conjunction with the value net it is part of. For example, instead of looking at the return on investment (ROI) of a renewable energy system, we can look at the system as an integral part of the house it goes into and the needs of the house's occupants. Today most houses are only considered livable if energy is available. Extended blackouts or a major energy crisis could make the house much less usable and, in particular for large energy consuming homes, it could make the property value plummet. Therefore, an alternative energy system reduces the risk of the house becoming less usable and less valuable in case of a lasting energy crisis. So part of what the system does is create a "value insurance policy" for the house itself.

To evaluate an alternative energy investment we need to take the value of the house and the value of that insurance policy into account in addition to the market value of the energy produced. Sometimes a poor system level ROI may turn out to be a great investment, taking the whole value net into account. The preservation of resources, such as ores, fossil fuels and even knowledge, follows much the same logic: should we optimize the net present value of the resource itself or should a broader value net perspective be taken? The latter would normally lead to a more conservational strategy. Some commercial insurance companies go proactively into helping their clients identify facility upgrade investment opportunities that can reduce future risks. While their motive is to keep insurance premiums low, the end result is similar to what is described here.

Market Power and Competition

If asked, most businesses would rather do without competition—internal or external—and from a market power perspective that is the optimal situation. However, from a long-term survival perspective it may not be so. The U.S. machine tool industry experienced in the 1980s a major decline. The industry consisted predominantly of smaller companies focusing on the local U.S. market which, with the exception of tools for the defense industry, was not very demanding.[104] At the same time many foreign companies faced global competition, and demanding customers, forced them to develop cost effective high-performance tools. When the U.S. market was opened up to foreign competition these companies gained significant market share at the expense of the local companies that previously felt less competitive pressure. The opposite can be said about the Swedish truck makers (Volvo and Saab Scandia) that developed under the influence of demanding domestic customers and fierce global competition leading to two successful companies. These examples might suggest that healthy competition may in the long run be better for a company.

Cost

A company focusing on surviving rapid changes may have to accept somewhat higher cost, such as: investment in modular and reconfigurable manufacturing systems, acceptance of less

leverage, tying the incentive and bonus systems to speed and creativity, and budgets that allow for mistakes and unforeseen cost overruns, to a larger extent than conventionally done. In a company focused on quick responses to market changes, project delays can cause much more harm than a cost overrun.

Strategy

A few other general areas can be helpful for survival under extreme business conditions. We can adjust the tactics continuously; perform small-scale strategy changes regularly and large-scale strategy adjustments occasionally:

- Keep the long-term direction and limitations in mind. It helps that the organization is "hungry" enough to have a reason for surviving. While the CEO may feel the pressure to make the company survive, many compliant employees often do not feel the pressure and resist the necessary changes. The software company Attivio had a set of clearly defined long term goals, and then every four weeks they would revise their short term tactic plans making it easier to accommodate changing customer needs, changing market conditions and technical developments / challenges.[105]
- Watch for red flags and adjust the scenario models on a regular basis (weekly, monthly or quarterly). No matter how comprehensive a strategic analysis we perform, it will rest on certain assumptions, and when these assumptions change we may need to revise the strategy. It is good to maintain a list of which events should trigger a red flag to go up.[106] It could, for example, be that the cost of capital goes up by 5 percent or that the competitor announces a new product.
- Regularly do a clean sheet of paper strategy. That is probably what a competitor new to the market will be doing, so can we compete against that competitor?
- Regularly redefine the strategy, and what strategic options should be kept open. The main strategy itself is likely to contain a family of related alternatives that can support each other and act as strategic diversification, even though they all point in the same overall direction.

---

93 Geoffrey A. Moore, 1995, *Crossing the Chasm*, HarperBusiness, New York, 256 p.

94 Christopher Meyer & Stan Davis, 2003, *It's Alive, the Coming Convergence of Information, Biology, and Business*, Crown Business, New York, 275 p.

95 Paul Hemp, 2004, Presenteeism: At Work—But Out of It, *Harvard Business Review*, vol. 82, no. 10, pp. 49-58, Oct. 2004.

96 Paul Lukas & Maggie Overfelt, 3M, *Fortune Small Business*, April 2003, pp. 37-43.

97 Kathleen M. Eisenhardt, 2001, Strategy as Strategic Decision Making, Chapter 4, pp. 85-102 in: Michael A. Cusumano & Constantionos C. Markides (eds.), 2001, *Strategic Thinking for the Next Economy*, MIT Sloan Management Review, Jossey-Bass, A Wiley Company, San Francisco, 317 p.

98 Ed M. Yoklay, (of Think Craft Inc.), 2002, Strategies for Speed Dependent Disruptive Business Environments, presentation at the American Chemical Society National Meeting, Boston, MA, 20 Aug. 2002.

99 Eric D. Beinhocker, 2001, Robust Adaptive Strategies, Chapter 6, pp. 131-155 and Peter J. Williamson, 2001, Strategy as Options on the Future, Chapter 7, pp. 157-178 both in: Michael A. Cusumano & Constantionos C. Markides, (eds.), 2001, *Strategic Thinking for the Next Economy*, MIT Sloan Management Review, Jossey-Bass, A Wiley Company, San Francisco, 317 p.

100 Eric D. Beinhocker, 2001, see previous note.

101 Hugh Courtney, Jane Kirkland & Patrick Viguerie, 1997, Strategy Under Uncertainty, pp. 1-31 in *Harvard Business Review on Managing Uncertainty*, 1999, Harvard Business School Press, Cambridge MA, 218 p. Originally published in *Harvard Business Review*, vol. 75, no. 6, pp. 66-79, November-December 1997.

102 The idea, named "six degrees of separation," has been discussed by a number of authors, see for example http://smallworld.columbia.edu/ (viewed 13 Oct. 2005).

[103] When the market is totally unpredictable (X=1), the value in the previous period is no indication of the value in the current period, and learning becomes irrelevant. This simulation was, however, set up so both types of organizations learn from the past market, which means that they get confused by market values going up and down at random. At total or near total randomness both organizations could have done better if they had realized this state and consistently selected the average market (0.5). In that case half of the time periods would have a value that in average would be 0.25 above the selected value, and in the other half of the time periods would be 0.25 below. That strategy was not incorporated into the model.

[104] David Finegold, Keith W. Brendley, Robert Lempert, Donnald Henry, Peter Cannon, Brent Boultinghouse & Max Nelson, MR-479/1-OSTP, *The Decline of the US. Machine-Tool Industry and Prospects for Its Sustainable Recovery*, vol. 1, 171 p. RAND.

[105] Presentation by Andrew McKay, at the Boston Knowledge Management Forum 23 February 2008.

[106] Kathleen M. Eisenhardt, see above.

Chapter 11
A New Product in a Simplified World

So how do all the ideas, discussed so far, come together and help us select which product to develop next? Before stepping into the complexity of the real world, it will help going through a simplified text book example. This example is entirely based on made up data, which was then analyzed in a way similar to what would be done with real data.[107] Imagine that we were to launch one or two new products targeting a specific market, and we would like to estimate the potential sales volume and profit. To begin with we have a value net (Figure 25), which here has been simplified to a point that it is no more than a short conventional value chain.

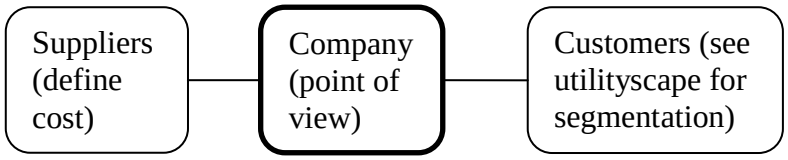


Figure 25. The value net

The products in this market help the customers solve two fundamental different problems, and have therefore two value drivers: performance (P, measured on a scale 1 to 5) and aesthetics / design (D, also measured on a scale 1 to 5). Performance is calculated as an aggregate score combining all the performance related features of the product (speed, power, precision of controls, etc.). The design score reflects relative ratings by customers in areas such as how modern / fashionable the casing is and how appealing the color options are. There is also one constraint variable: cost of purchasing and ownership (C).

Price

The market price will depend on customer value, risk and market power.

Customer Value

The price a customer at most is willing to pay for a product depends on the value the customer expects to receive from it. Value drivers can help us estimate the monetary base-value assigned to the product by a given customer. We can base the estimates on what the customer is already paying to obtain a similar utility or from the size of the savings that the product brings. If it is a new product where there is no directly relevant historical data, we can learn from other markets. For example, we can learn about the value of user-friendly software from the computer industry and the value of an appealing design from other product categories.

Value Adjusted for Risk

With a new product, most customers will wonder about how much value they ever will be able to harvest, and naturally will discount the product accordingly. Many looming threats include: product failure, poor levels of service and support, risk of not having the expected needs, risk of

obsolescence, and risk of not becoming a proficient user. If we, through marketing, can educate the potential users and convince them about the benefits, then the discount will be less. A warranty or a money-back guarantee can also help reduce the risk and thereby increase the risk discounted value. For financial products it is customary to discount their value according to how risky they are. We lack a similar well established method for discounting the value of consumer products, but here again historical data from other products can help us. For example, many electronics retailers sell extended warranties, and from that we can estimate the discount associated with the risk of a product failure.

Market Power

If value is depicted by the size of a cake, then market power describes how large a slice of that cake we possibly can get. The user will look at the entire value they can derive from the product. It is possible to charge for value that others create, including value created by the customer, however, in order to do so we must possess adequate market power. It is easier to create value than to charge for it. There are two aspects of market power. The market power relative to the customer determines how much of the value to the consumer actually can be charged as a selling price – and the more competitors are offering the customer alternatives the more power the customer has. The market power, among the suppliers of complementary products, determines how much each of them can get. Even for a new product with no direct competition, there will be indirect competition from all the other potential ways customers can solve the basic problems addressed by the value drivers.

The relative profitability of various existing industries provides a clue to how a new product will fare in the battle for market power. Many "conventional" businesses are used to thinking of the market price as "cost plus"; however, that assumes there is strong competition and that the suppliers are willing to quit doing business if they cannot get their "plus" above cost. That type of market weakness may not apply to a new product. The market power to the supplier tends to go up as the market grows. Any single customer becomes less important and the suppliers will become more dependent on the product. However, once a competitor enters, the market the market power will go down.

Price Ceiling

We are now ready to look at the price we can charge. Each customer has a different perception of value, risk and market power, and for some products each customer acts as a market in itself, with its own price setting (e.g. through negotiation). However, for a consumer product in a certain geographic / customer region there is often only one market with fairly well defined prices relating back to the variables discussed. In this example it is assumed that there is a base price which is set as follow:

Value, V = 0.3*(1 + D + P + D*P)
Risk discount, R = 1.20
Market Power (MP) and pricing decision factor (h), MP*h = 0.8
Price, P is then:

$$P = h \cdot MP \cdot \frac{V}{R} = 0.8 \frac{0.3*(1+D+P+D*P)}{1.2} = 0.2*(1+D+P+D*P)$$

where D and P are the value driver scores. This estimates the base price: the fraction of the risk adjusted value we can capture, thanks to our market power position. Prices are in $100s.

As the market matures we typically see a decline in the prices. In this example the base price will be higher or lower by the following factor (f), relating the total amount of products (cum. vol., measured in 1000 units) sold in this market since the initial product launch:

$$\ln(f) = \ln(10) * (0.9 - \log(\text{cum. vol.}))$$

In this way more and more customers will be able to afford making a purchase as the market matures. The initial market size is 1500 units. This product is "perishable", so customers will keep purchasing the product as repeat customers. When prices drop to one, they are maintained at that price level.[108]

Sales Volume

If there had been an infinite amount of different product offerings available, the customers would have distributed themselves in the utilityscape as shown in Table 5 and illustrated in Figure 26. The utilityscape is like a demographics map showing where the customers ideally would like to "live" in terms of value driver combinations. In this example most customers prefer a combination of medium performance with medium good design characteristics – or a little above that. In a real world case this could be mapped by surveying customer preferences for different product features, and then aggregating this to form value driver scores.

Table 5. Native demand for different value driver combinations in this example

	D = 1	D = 2	d = 3	D = 4	D=5
P = 1	2.5%	3.5%	4.0%	4.0%	3.5%
P = 2	3.5%	4.0%	4.5%	4.5%	4.0%
P = 3	3.5%	4.5%	5.0%	5.0%	4.0%
P = 4	3.5%	4.5%	5.0%	4.5%	4.0%
P = 5	3.0%	4.0%	4.0%	4.0%	3.5%

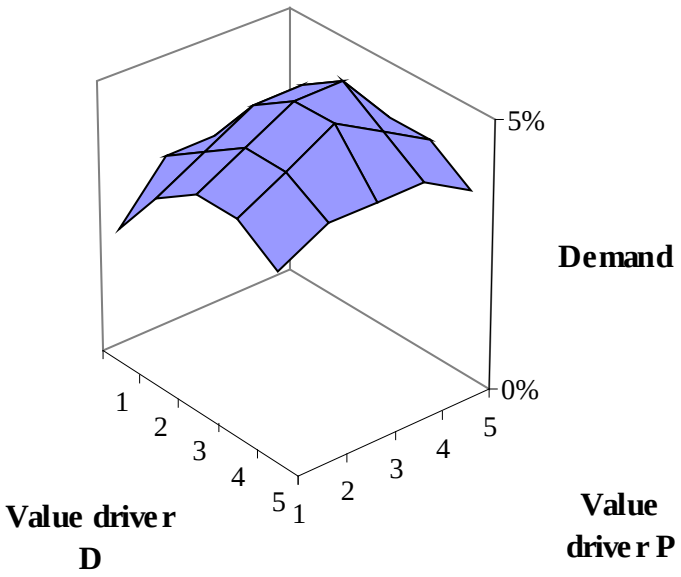


Figure 26. Utilityscape showing which percentage of all customers select different value driver score combinations. The axes are relative going from low (1) to high (5).

Regarding the one constraint variable: Product base prices and the customers' purchase abilities at those prices are shown in Table 6. This example is constructed such that sales would total 100% (i.e. affordable by everyone) if prices dropped to 1. This figure illustrates how the market expands as the price drops – as expected. As the cumulative volume increase the prices will drop and the market grow. In a real world case this would have been based on how much money the customers today are spending in similar areas.

Table 6. Base prices (in $100) and percent of customers who is willing to purchase at that price

	D = 1		D = 2		D = 3		D = 4		D=5	
P = 1	$1.00*	100%	$1.20	83%	$1.60	63%	$2.00	50%	$2.40	42%
P = 2	$1.20	83%	$1.80	56%	$2.40	42%	$3.00	33%	$3.60	28%
P = 3	$1.60	63%	$2.40	42%	$3.20	31%	$4.00	25%	$4.80	21%
P = 4	$2.00	50%	$3.00	33%	$4.00	25%	$5.00	20%	$6.00	17%
P = 5	$2.40	42%	$3.60	28%	$4.80	21%	$6.00	17%	$7.20	14%

*Adjusted as explained in the text.

Elasticity of Demand

The problem is that there is not going to be a product that matches every customers taste and budget. So what do customers do when they cannot find their first choice? Some customers are going to settle for a second best option, while others may not purchase anything at all. Price elasticity of demand (or other constraint variable related elasticity of demand) tells us how much a change in price will affect demand. Figure 27 shows this graphically.

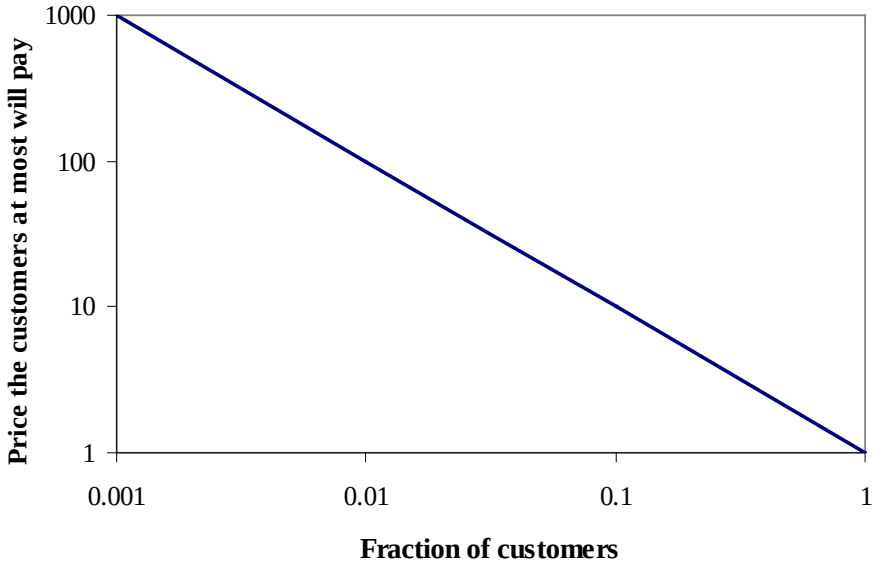


Figure 27. Customers willingness to pay[109]

In a similar manner, value driver elasticity of demand tells us how big an impact a compromise in a value driver will have on sales. Evidently the impact will not be the same for every value driver, or if the deviation from the ideal is for the better or for the worse. Figure 28 illustrates the relationship as used in this example.

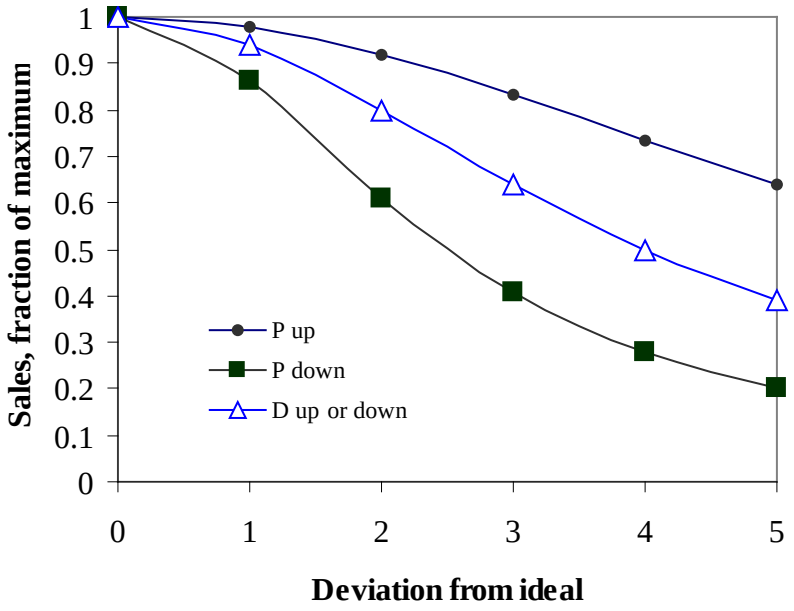


Figure 28. Value driver elasticity of demand

Normally customers accept tradeoffs between all the key variables, value drivers and constraint variables, so if the customers feel that they get a lot more in terms of value they will be willing to pay a little more in terms of money. In this simplified example the following simplifications are assumed:

- There is no relationship between product preferences (ideal value driver score combination) and financial abilities (budget constraint). In other words, having an expensive taste is totally independent of being able to spend a lot of money or not.
- If two products occupy the same field in the utilityscape they share the sales evenly, but the total volume remains the same.
- Customers, who cannot find their ideal product, calculate a "penalty score" (PS) for each available option. The product with the lowest penalty score becomes the product of choice for that customer.[110]
- The probability of a sale (X_{sale}) will decrease as the penalty score increases. In this example it is assumed that the relationship is as follows (see Figure 28):

$$X_{sale} = \frac{1}{1+\left(\frac{PS}{100}\right)^2}$$

Cost

The cost to the company, associated with a product, is assumed to be:

$$\text{Total cost} = \text{Sales} * (0.1 + 0.45 * P) + 0.1$$

where the P is the market price. In this way the cost decreases over time reflecting that the company becomes more efficient and obtain better deals from the suppliers as the volume increases. Sales of any given product in any given month cannot exceed 10% of the total historical market sales. This limitation is imposed because in real markets there will always be a limit to how fast a new company can ramp up production.

Profit Opportunities

If we were to introduce, one or two products, which ones should that be? Based on the assumptions listed above we can calculate sales volumes, prices, costs and profits. By iterating the net present value has been calculated for each product option, or combination of products. The calculations were done assuming a 10 year life (120 monthly calculations) and no competitors entering the market space during that period. Table 7 and
Table **8** show the estimated net present values for each product or product combination.

For the higher end products the volume will go down a little as fewer customers can afford them; however, that is made up by higher price per unit sold. An expensive product, sold in small quantities, will not bring the price down as quickly either, preserving the "exclusivity" of this market for longer. However, choosing this strategy will be an invitation to the competition to capture the business from all the customers left out.

The larger the penalty score is for being one value driver unit off, the more important it is that there are products in the vicinity of the customers' wishes. So for large penalties that would mean that there need to be products near the center of the diagram in Figure 26. On the other hand, if the customers really "need" a solution and therefore think "any product is better than no product", then the supplier can benefit from forcing the customers to upgrade to more expensive solutions, as long as the competition does not step in and offer a more cost effective alternative. Both aspects are important here.

If we were only going to launch one product it could be D=4, P=4, which provides the highest net present value (Table 7). It is not the product in highest demand, enough customers are willing to "upgrade" and accept a higher price – leading to higher profits.

Table 7. Estimated net present values for different products, if only one product is sold

	D = 1	D = 2	D = 3	D = 4	D=5
P = 1	6.9	9.3	10.6	10.7	9.4
P = 2	11.1	14.4	16.4	16.5	14.8
P = 3	14.4	18.6	21.0	21.3	19.1
P = 4	16.2	21.0	23.8	**24.0**	21.4
P = 5	16.1	21.2	23.9	23.9	21.1

Table 8. Estimated net present values if two products are sold (the table is symmetrical so only one half is shown). First products listed horizontally, second products listed vertically.

D		1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5
	P	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1	1	6.9																								
1	2	5.2	11.1																							
1	3	9.1	8.9	14.4																						
1	4	11.4	11.9	11.0	16.2																					
1	5	10.8	12.8	12.4	11.0	16.1																				
2	1	3.7	5.0	9.1	11.9	12.7	9.3																			
2	2	9.2	9.6	10.0	12.3	13.7	9.2	14.4																		
2	3	12.5	14.6	14.4	13.9	14.0	14.1	13.5	18.6																	
2	4	15.2	15.2	18.0	17.4	16.2	17.2	17.1	16.1	21.0																
2	5	15.8	16.3	14.8	19.0	18.0	16.3	18.5	17.8	16.3	21.2															
3	1	5.2	7.4	9.6	12.7	12.9	5.6	8.8	13.4	16.7	17.8	10.6														
3	2	10.8	11.6	13.7	14.7	14.7	12.3	12.0	13.2	16.7	18.4	11.6	16.4													
3	3	15.9	16.8	16.8	18.8	18.4	16.0	18.2	17.4	17.4	18.2	17.3	16.4	21.0												
3	4	18.8	20.5	20.4	20.0	21.6	19.4	19.0	22.1	20.7	19.5	20.9	20.6	19.2	23.8											
3	5	17.5	21.3	21.9	21.4	20.6	20.3	20.5	19.2	23.3	21.4	19.7	22.4	21.2	19.5	23.9										
4	1	6.3	8.3	10.4	12.4	13.6	6.3	9.3	13.8	17.5	17.3	6.0	11.1	16.0	19.8	21.1	10.7									
4	2	11.8	13.4	14.4	15.9	16.6	11.6	12.9	15.7	17.1	19.3	13.4	12.5	15.8	19.2	21.2	12.3	16.5								
4	3	16.0	18.3	18.9	19.2	20.2	17.9	17.7	18.3	20.7	20.3	17.0	19.5	18.0	18.7	20.2	18.4	17.1	21.3							
4	4	18.6	20.3	22.3	22.4	21.8	21.4	22.5	22.0	21.8	23.4	20.8	20.3	23.4	21.4	20.2	22.3	21.6	19.9	24.0						
4	5	19.4	20.9	21.2	23.7	23.3	19.8	23.9	24.3	23.6	22.5	21.9	22.2	20.9	24.4	21.6	20.7	23.7	22.0	19.6	23.9					
5	1	5.0	8.5	10.8	12.4	12.5	6.6	9.6	12.8	16.6	18.0	5.6	9.9	16.4	20.5	20.1	4.8	11.6	16.6	20.6	22.1	9.4				
5	2	9.8	11.3	14.6	15.8	15.8	11.5	13.4	15.5	17.7	17.8	9.9	12.0	15.9	19.4	21.8	12.4	11.0	16.1	19.3	21.3	11.1	14.8			
5	3	14.4	15.7	16.2	19.3	19.3	16.1	17.9	19.1	20.0	21.2	17.0	15.9	17.3	20.3	19.9	15.7	18.0	16.1	18.5	19.1	17.1	15.2	19.1		
5	4	17.6	19.1	19.4	19.2	22.0	18.5	20.2	22.5	22.7	22.2	20.5	21.5	20.3	20.6	21.8	19.5	19.0	21.3	18.9	18.2	20.9	19.6	17.2	21.4	
5	5	16.9	20.5	21.0	20.7	19.9	19.7	20.9	21.8	**24.6**	23.6	18.7	23.3	23.3	22.2	20.8	20.8	21.0	19.8	21.8	19.0	19.0	21.5	19.5	17.0	21.1

If we were to introduce two products, the calculations suggest D=2, P=4 and D=5, P=5. That is one on each side of the peak demand area in the utilityscape, and pushed towards the higher price end. Interestingly enough, having two products only increase the net present value by 2.5%. If sales would have dropped more steeply in response to a poor match with the original customer wishes, then there would have been a much stronger argument for having two products in the market. However, it is not clear that the two product alternative is the way to go when the assumptions about the market are as outlined above.

Technology Adoption

We can look at the sales volume of two products (D=2, P=4 and D=5, P=5) in each of the 120 month (Figure 29). Not surprisingly the shape resembles a traditional S-Curve seen for the adaptation of new products.[111] Early growth is limited by the constraint variables such as price, supply (limits to how fast production can ramp up) and distribution / availability. Later on growth is limited by the value variables: As the market matures the prices come down and if they come far enough down anyone interested in the product is getting it. The last part of the curve is exclusively driven by general price changes. The point on the curve in Figure 29 where there is abrupt change in the slope reflects the transition from supply- to demand-imposed limits to the

market size. For some of the other product options adoption goes faster, and the cumulative volumes may be higher, however, the profits are lower.

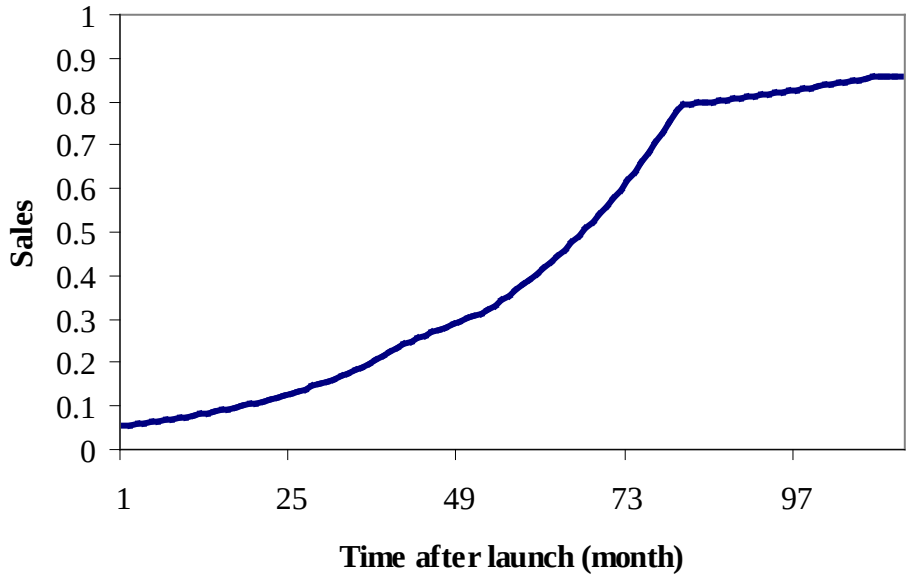


Figure 29. Sales per time period based on the example discussed in the text

Discussion

The evaluation in this example was performed in the way outlined in Figure 30. First, the ideal market was established to describe what the customers are wishing for in terms of key variables. Second, the actual market, was established by taking into account the trade-offs the customers will have to do in a market with a limited number of products. Third the limitations imposed by the company, such as their cost structure is introduced. And finally the results are calculated giving the net present value and market development. The calculations were repeated in order to evaluate all product options, and the results can be used to support the development of a good product strategy.

Numbers help us support business decisions, not dictate them, so these results need to be combined with other considerations. If a competitor threatens to enter the market, we might, for example, consider a different pricing strategy. What if we were off in our initial estimates of the relative importance of the different value drivers? One approach is to utilize a modular product design, where the modules can be reshuffled as needed, and if we erred initially, only some of the modules need redesigning, rather than having to rebuild the entire system. Having multiple product configuration choices in the market at any given time allows the customers to select what gives them the most value. And we can learn from the customer choices.

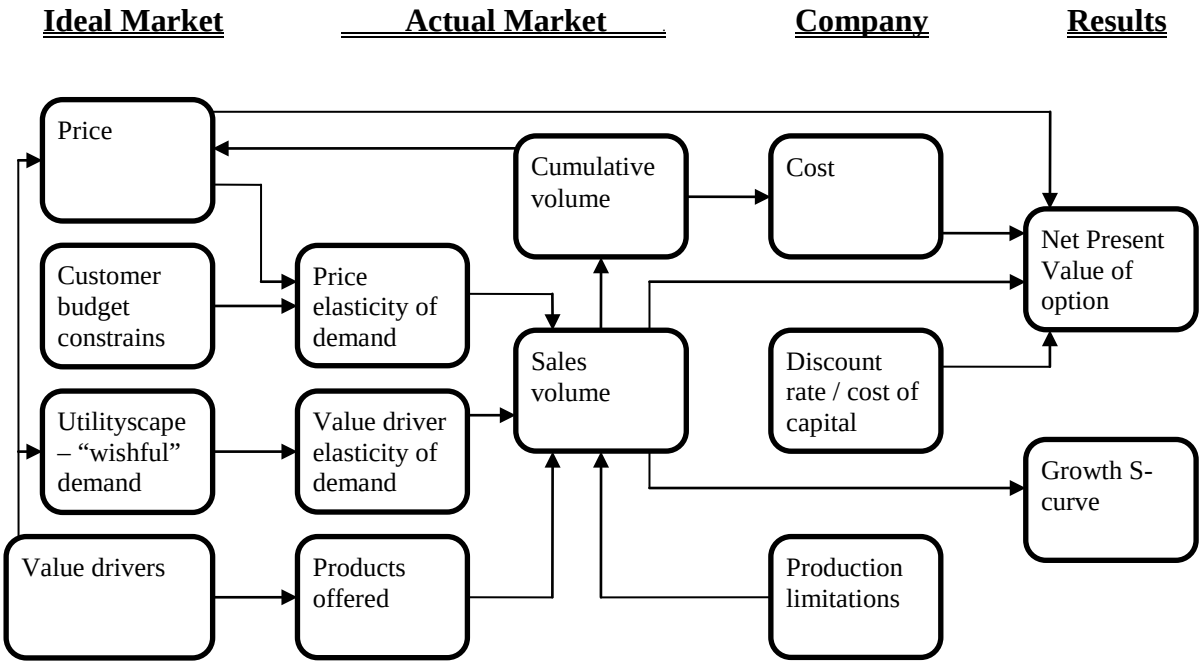
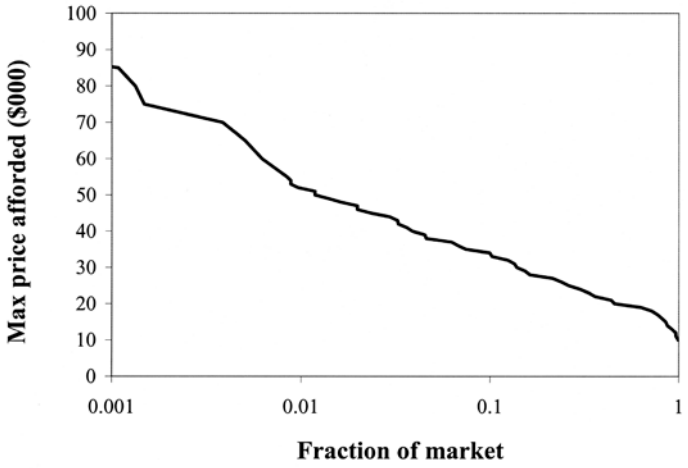


Figure 30. Diagram of the process used to calculate the results in this example

[107] The data processing was done using a custom built C++ program (by the author), which systematically evaluates every possible set of products over a specified period of time by combining the demand from every possible customer segment. The methods and assumptions used are discussed in this chapter. It is easy to modify these assumptions, and the ones used were just selected in order to have something (simple) to work with.

[108] The reason for maintaining the prices at one (1) is that it is assumed that 100% of the customers can afford this price, so the company does not gain anything from dropping the prices further.

[109] An example from the real world:



Cumulative graph showing the actual spending on new cars with the x-axis being the fraction of the market and the y-axis being the purchase price in $-thousands. Data for this figure comes from the sources used in chapter 11 and 12 (see first edition of the book).

[110] The penalty scores are calculated as follows:

Value driver	Each step down	Each step up
P	40	15
D	25	25

These scores reflect that there is a large penalty for not meeting performance expectations, a small penalty for having too much performance and an even penalty for changing the design in either direction away from the ideal.

[111] E.g., Vijay Mahajan, Eitan Muller and Frank Bass, 1990, New Product Diffusion Models in Marketing: A Review and Directions for Research, *Journal of Marketing*, vol. 54, pp. 1-26 and Johan Norton and Frank Bass, 1992, Evolution of Technological Generations: The Law of Capture, *Sloan Management Review*, vol. 33, no. 2, pp. 66-77, Winter 1992.

Chapter 12
The U.S. Car Market

This chapter combines the theory developed in the previous chapters with data to develop an understanding of the market for cars in the U.S. In the following chapter the results will be used to analyze the opportunities for a vehicle new to this market.

Car Data

This case study (Chapters 12 and 13) has been based on historical data for 267 models of light vehicles sold in the U.S.[112] These models account for more than 99 percent of the country's 2003 volume. Only very low volume specialty brands were left out. Each model is described by 64 variables. These variables encompass vehicle characteristics/specs, the price range, sales volume, buyer's age profile as well as sales and marketing related data. For most of these variables both a low and a high value were included reflecting the range of the various trim levels that a model covers. The data was normalized to facilitate comparison.

While these variables are relevant, a more meaningful classification is required to better understand the market. To this end, we can consider the following: Any car can be considered to fulfill five basic needs: (1) provide transportation, (2) deliver comfort and pleasure, (3) offer fun during the ride, (4) enhance the owner's social standing and (5) manage cost constraints (Table 9). These needs become the five basic value drivers of a vehicle, and of course they differ in importance with every customer. Each characteristic of a car impacts one or more of these dimensions (Table 10). While the satisfaction of a need adds value to the customer, this value is reduced by various risks. In response to these risks the carmakers offer risk-mitigating measures which also have been included in these tables.

Pleasure, driving fun and cost savings are relatively straight-forward dimensions from the perspective of "more is better" as perceived by the majority of customers. For example, if a vehicle is offered with more horsepower at no additional cost and without affecting the fuel economy, then most people would prefer the extra power.

When considering the transportation and social dimensions, more is not necessarily better; rather, people have an ideal somewhere on the scale. Furthermore, these dimensions are each multidimensional. Transportation could be considered two-dimensional: ability to transport (1) people and (2) cargo. The social-standing dimension is complex: for example, some customers seek an "optimal" environmental image, some focus on prestige, and others focus on a power appearance. The optimum represents an optimal fit within the framework of the driver's social network. Often people desire to be in the upper end of their social group, but not way outside it. For instance, does a Rolls-Royce help a construction worker fit *in*, when parking among the full-size pickup trucks on a construction site? Not necessarily.

Table 9. Vehicle value drivers

Dimension	Need satisfied	Risk mitigation
Transportation	Land transport	Reliability, occupant safety
Pleasure and aesthetics	Comfort and styling	Pre-purchase evaluation
Fun	Driving enjoyment	Test drives, magazine evaluations
Social standing	Others' opinion	Advertisement
Cost savings	Limit resources spent on vehicle	Warranties, maintenance

Table 10. Selected variables classified according to the value drivers they impact

	Variables and risk reduction
Transport (T-dimension)	• Vehicle size (length, height, width, wheelbase) • Vehicle shape ("ability to transport") from two-seat roadster to full-size van • Seating capacity • Number of doors • Cargo volume or cargo payload, towing capacity • Empty weight • Bumper-to-bumper and power-train warranties • Occupant safety and vehicle reliability ratings belong here but have not been included due to incomplete data • Engine size and horsepower
Pleasure (P-dimension)	• Luxury level • Ride quality • Interior styling and ease of use • Interior space, comfort and noise level • Doors per seat (for ease of entry) • Type of transmission • Convertible or not • Design. Higher scores if design stood out as true three-dimensional sculpture with attention to detail • Retro/futuristic design or not • Body corrosion warranty—reduces risk of a shabby-looking car
Fun (F-dimension)	• Acceleration (inverse of time to reach 60 mph) • Power-to-weight ratio • Torque-to-weight ratio • Handling/steering • Driving wheels (which wheels pull) • Sportiness and size (smaller is better)
Social: (S-dimension)	• Brand image • Price (more expensive is more prestigious) • Luxury level • Environmental image: hybrid or not • Ratio of horsepower to engine volume. It was found that upscale cars tend to have more advanced engines with higher ratios • Engine (cylinders, liters, horsepower, torque) – numbers to impress others with
Cost (C-dimension)	• Price • Fuel economy (for urban and highway driving) • Expected maintenance: cost and time spent on car repair should be here, but have not been included due to incomplete data • Various types of warranties and free scheduled maintenance

Note: Subjective variables were rated on a scale 0 through 10. Units are not shown as all variables are normalized. Some variables were considered more important than others in defining the dimensions.

To keep this case study simple, only the first four dimensions (transport, pleasure, fun and social) are used in the following discussion; the cost savings, being somewhat collinear with the other dimensions, was left out. A weighted average score was calculated for each of the four dimensions for each of the 267 models. Because most variables have a high and a low value, every car model displays a range in each dimension.

Car Pricing

According to Chapter 6 we can expect a pricing model to include the value drivers, risk and market power. However, in this case study it turned out that the market power factor was secondary to the other factors. Exotic car brands were left out, so it is not surprising that all the cars in the study were competitively priced or at least that market power correlated with some of the value parameters. So as a first approximation we can thus assume that the price relates to the risk discounted value to the customer (*V/R*). That means that the five value drivers (transport, pleasure, fun, social standing, and cost of ownership—including their risk-mitigating measures) should be determining for the price. The following equation for competitive market prices was developed:[113]

$$Price(\$) = \exp(10.42 + 0.28T + 0.075P + 0.25F + 0.28S - 0.044C) - 7{,}000 \qquad (12\text{-}1)$$

where T stands for transportation, P for pleasure, F for fun, S for social standing and C for cost to the owner, all measured in terms of standard deviations above or below the average vehicle. Figure 31 compares observed and estimated prices.

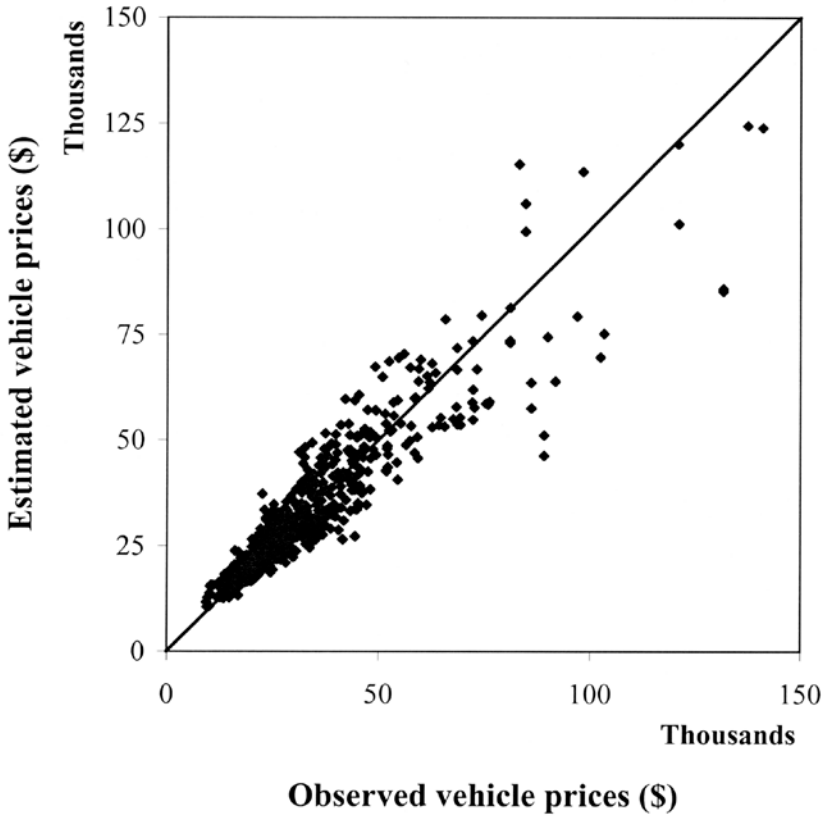


Figure 31. Comparison of pricing estimates to the actual prices. The diagonal line is the ideal 1:1 relationship between observed and predicted prices.

In the low price range the estimates are on average slightly above what is expected. This presumably reflects a more intense price competition in the low price range, depressing the actual market prices. If market power had been taken into account, this could have been accounted for.

The Utilityscape for Cars

We can use the utilityscape introduced in Chapter 5 to analyze the car market. The simplified utilityscape (disregarding cost of ownership) includes four dimensions: transportation, driving fun, pleasure and social standing. Any car model will plot somewhere within this four-dimensional utilityscape, and different trim levels serve to spread a model over a larger volume.

Customers settle at the location in the utilityscape they like the best among those of the available choices they can afford. If they, due to budget constraints or lack of vehicles offered, cannot buy what they really would like they will feel "pain," and in general customers will attempt to minimize this by seeking an alternative as close to their ideal car as possible. The sales volume thus depends on how the customers distribute themselves after they have made any tradeoffs. This description is superior to a market-segmentation where the boundaries are defined based on one-dimensional characteristics such as body style (subcompact, full-size sedan, SUV) which may not reflect customer desires. For example, a performance-seeking customer may consider a BMW X5 and an Audi A6 Quattro despite the first being an SUV and the other a sedan, while a customer may *not* consider a Ford Mustang and a Porsche 911 as substitutes despite both these vehicles being traditionally classified as sports cars.

A utilityscape is a continuous shape without sharp boundaries, and it should ideally be treated as such. However, for this case study the utilityscape is divided into subgroups, each of which covers a limited range in each of the four basic value drivers. Each dimension is divided in a way so that one-third of the vehicles sold fall in each of three segments. That resulted in the cutoff limits in terms of standard deviations above or below average shown in Table 11. The exact location of these cutoff limits in the utilityscape proved unimportant for the final results. Later on in the case there is another example using five, instead of three, divisions. With three segments in each of the four dimensions, the utilityscape is divided into 81 subgroups ($3^4 = 81$). Each vehicle was then classified according to which subgroup or subgroups it fell into. If a vehicle spanned three subgroups the sales would be divided among those according to how much overlap the vehicle's range of characteristics has with each of them. So a subgroup will include vehicles of several brands and models, but not all of a given model will fall in a particular subgroup. Table 12 shows examples of two of the subgroups. By adding up the sales of the vehicles in each subgroup we can see how the customers distributed themselves across the utilityscape (Figure 32). An explanation of how to read this and subsequent multi-dimensional utilityscape figures is given in the notes.[114]

Customers of the 36-55 age group buy 49.2 percent of all the vehicles, while the younger ones buy 25.3 percent and the older ones buy 25.5 percent. But the distribution of sales among age groups varies across the utilityscape. Figure 33 shows which age group buys the most vehicles above the average for their group. It reveals that the middle age group dominates sales in the high transportation region, reflecting that people in this age group often have families with children and need the most transportation capability, and/or work at a job that requires a truck. The younger age group has only half the sales of the middle age group, although the number of people is about the same, and the desire for individual transportation is at least as high. This reflects the lower buying power of the younger customers, forcing them to consider used cars and other means of transportation. Furthermore, the 16-35 age group dominates the lower end of all dimensions, again reflecting their limited buying power. The oldest of the three age groups (56+) gravitate toward the end of the utilityscape representing the lowest need for transportation; however, contrary to the younger age group, a larger fraction of customers in this age group can afford more expensive vehicles as reflected in their liking for the more expensive subgroups with higher P, F and S scores.

Table 11. Cutoff limits for the classification of vehicles into 81 subgroups, shown as standard deviations above or below average

Dimension	Transportation (T)	Pleasure (P)	Fun (F)	Social (S)
Segment 1 (33.3%)	Up to -0.306	Up to -0.113	Up to -0.237	Up to -0.242
Segment 2 (33.3%)	-0.306 to 0.391	-0.113 to 0.128	-0.237 to 0.116	-0.242 to 0.009
Segment 3 (33.3%)	Above 0.391	Above 0.128	Above 0.116	Above 0.009

Table 12. Examples of vehicles in different subgroups

T	F	P	S	Vehicles
1	1	1	1	Chevrolet Aveo 1.00, Hyundai Accent 1.00, KIA Spectra 1.00, Suzuki Forenza 1.00, KIA Rio 0.98, Suzuki Esteem 0.87, Jeep Wrangler 0.43, Ford Focus 0.29, Hyundai Elantra 0.21, KIA Sportage 0.08, Pontiac Grand Am 0.05
3	2	3	2	Isuzu Ascender, 0.70, Chevrolet Avalanche 0.56, Chevrolet Suburban 0.47, GMC Envoy 0.42, Chevrolet Tahoe 0.40, Oldsmobile Bravada 0.39, Chrysler Town & Country 0.31, Chevrolet Trailblazer 0.27, Chrysler Pacifica 0.25, GMC Yukon XL 0.21, GMC Yukon 0.20, Mercury Mountaineer 0.19, Buick Rainier 0.11, Ford Explorer 0.03, Dodge Caravan 0.03

Note: The numbers following each car indicate what fraction of the sales of a particular model falls within the subgroup—the higher the number the more the vehicle is targeted toward that particular subgroup.

		T1			T2				T3			
P1		**S1**	**S2**	**S3**		**S1**	**S2**	**S3**		**S1**	**S2**	**S3**
	F1	298	87	235	**F1**	685	196	202	**F1**	443	466	97
	F2	753	195	41	**F2**	110	31	13	**F2**	147	184	46
	F3	324	232	147	**F3**	19	26	8	**F3**	207	291	31
P2		**S1**	**S2**	**S3**		**S1**	**S2**	**S3**		**S1**	**S2**	**S3**
	F1	18	55	111	**F1**	230	327	56	**F1**	487	519	130
	F2	154	243	166	**F2**	415	263	107	**F2**	181	255	142
	F3	68	190	337	**F3**	354	377	163	**F3**	74	113	19
P3		**S1**	**S2**	**S3**		**S1**	**S2**	**S3**		**S1**	**S2**	**S3**
	F1	10	28	94	**F1**	23	114	89	**F1**	149	338	67
	F2	115	100	294	**F2**	77	177	422	**F2**	73	445	402
	F3	116	184	958	**F3**	14	36	1018	**F3**	10	79	156

Figure 32. Sales (in thousands) in the various subgroups, as defined by the value drivers transport (T), pleasure (P), fun (F) and social (S) - each of which has been divided into three segments (1, 2, 3), e.g., the sales for T1, P2, F3, S1 were 68,000 units.

For a market of 16.6 million cars per year, a utilityscape with 81 subgroups is not a whole lot, and some of the fields end up grouping cars that really cannot be described as close substitutes. We can therefore use a finer subdivision of the value driver axis, e.g., with five intervals on each of the four axis. That gives a total of 625 subgroups ($5^4 = 625$), (Table 13, Table 14 and Figure 34). The division of each axis was done in the following manner: 10 percent of sales fall in groups 1 and 5, 20 percent in groups 2 and 4, and the remaining 40 percent in group 3. Having smaller percentages in the high and low ends allow us to separate out the “extreme” cars that typically sell in lower volumes. Table 14 gives examples of cars in subgroups defined in this way.

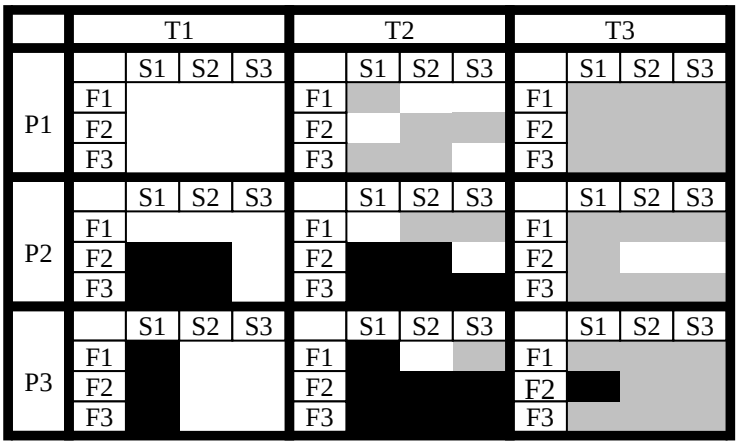


Figure 33. Utilityscape with age preferences plotted. The figure is similar in construction to Figure 32. Legend: white is ages 16-35, grey is ages 36-55 and black is ages 56+.

Table 13. Cutoff limits (standard deviations above or below average) for the classification with 625 subgroups

Dimension	Transportation (T)	Pleasure (P)	Fun (F)	Social (S)
Segment 1 (10%)	Up to -0.685	Up to -0.450	Up to -0.558	Up to -0.390
Segment 2 (20%)	-0.685 to -0.351	-0.450 to -0.141	-0.558 to -0.255	-0.390 to -0.264
Segment 3 (40%)	-0.351 to 0.475	-0.141 to 0.158	-0.255 to 0.157	-0.264 to 0.046
Segment 4 (20%)	0.475 to 0.997	0.158 to 0.419	0.157 to 0.624	0.046 to 0.770
Segment 5 (10%)	Above 0.997	Above 0.419	Above 0.624	Above 0.770

Table 14. Examples of subgroups from the utilityscape with 625 subgroups

T	F	P	S	Vehicles
1	3	1	1	Chevrolet Cavalier 0.76, Suzuki Esteem 0.15, Ford Focus 0.05, Dodge Neon 0.02
2	4	3	5	Jaguar X-type 2.5l, 1.00, Volvo C70 0.92, Acura CL 0.22, Lexus IS 300 0.12, Saab 93 0.09, Mercedes C-class 0.07, Volvo S60 0.06, Audi TT 0.05, Mercedes CLK 0.02
5	1	3	3	GMC Savanna 0.23, Ford Expedition 0.22, Chevrolet Express 0.19, GMC Sierra 0.02, Chevrolet Silverado 0.02, Ford F-series, 0.02, Dodge Ram Pickup 0.01

Note: Only vehicles with more than 1 percent of sales in the subgroup are mentioned.

The utilityscape presented here is relevant to the 2003 U.S. car market. However, it is interesting to note that all five value drivers predate the invention of the car, and if we in year 1884 had wanted to know something about the market for the first cars we could have turned to horse wagons, trains, horses and bicycles as a basis for establishing a relevant utilityscape.

Market Share within a Subgroup

It can be a useful first step to look at the individual subgroups as isolated markets assuming that all vehicles within a given subgroup directly compete with each other but they do not compete

with vehicles from other subgroups. The data set used is incomplete as many of the factors driving market share resist description through the quantitative data available, however, the following approximation for the market share, X, of a model n within a subgroup was established (Table 15, Figure 35):

$$X_n = \frac{1}{N}(1 + a_{PR}PR + a_{OV}OV + a_{XM}XM + a_{VA}VA + a_{YM}YM + a_{YB}YB + a_{AD}AD + a_{IT}IT + a_{IN}IN + a_{DE}DE) \qquad (12\text{-}2)$$

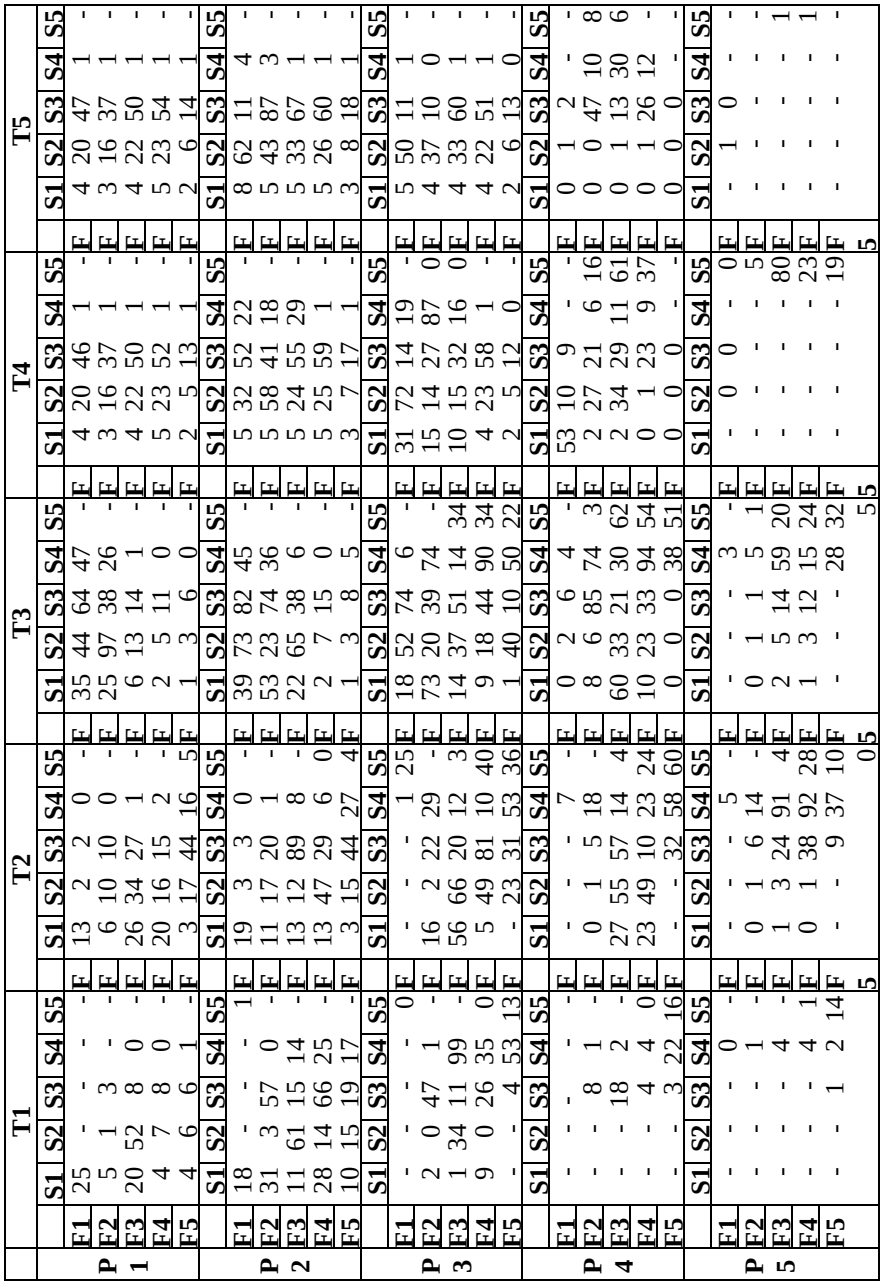


Figure 34. Utilityscape with 625 subdivisions: sales in thousands of cars. "-" indicates no vehicles offered

Table 15. Coefficients and r^2 for the market share model[115]

Coefficients	All age groups	16-35	36-55	56+
Price: a_{PR}	-0.94 ± 0.11	-0.91 ± 0.11	-0.75 ± 0.11	-1.18 ± 0.13
Overlap: a_{ov}	0.036 ± 0.02	0.045 ± 0.015	0.038 ± 0.014	0.040 ± 0.016
In group: a_{XM}	0.38 ± 0.014	0.25 ± 0.03	0.34 ± 0.02	0.46 ± 0.03
Varieties: a_{VA}	0.36 ± 0.03	0.46 ± 0.03	0.40 ± 0.03	0.26 ± 0.03
Years model has been in market: a_{YM}	0.081 ± 0.020	0.068 ± 0.022	0.052 ± 0.020	0.11± 0.02
Years brand has been in market: a_{YB}	-0.22 ± 0.08	-0.20 ± 0.09	-0.24 ± 0.09	-0.23 ± 0.09
Brand ad spending: a_{AD}	0.22 ± 0.05	0.36 ± 0.06	0.26 ± 0.05	0.085 ± 0.059
Internet popularity: a_{IT}	0.29 ±0.05	0.27 ± 0.05	0.33 ± 0.05	0.29 ± 0.05
Dealer incentives: a_{IN}	0.074 ± 0.037	0.050± 0.041	0.055± 0.037	0.14± 0.04
Number of dealers: a_{DE}	0.41 ± 0.07	0.16 ± 0.08	0.35 ± 0.07	0.62 ± 0.08
r^2	0.55	0.49	0.55	0.48

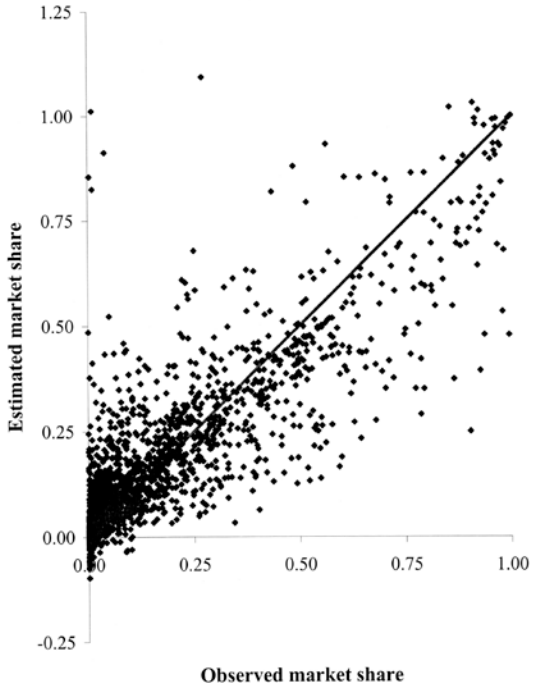


Figure 35. Comparison of actual and estimated market shares within subgroups for all age groups

N is the number of competing models within a subgroup; if a model has been introduced or discontinued during the year it counts only as half. The a's are coefficients. *PR* is the minimum price for the part of the vehicles that falls within the subgroup, *OV* is the overlap with the subgroup quantifying if the vehicle span the whole subgroup or it only occupies a small fraction thereof, *XM* is the fraction of vehicles, of a model, sold within the subgroup—the higher *XM* is

the more the model targets specifically that subgroup, *VA* is the number of varieties or trim levels of a model offered within the subgroup—the more varieties the better are the possibilities for exactly matching the customer's desires, *YM* and *YB* are the number of years in the market for a given model, and a given brand, respectively, *IT* is the Internet popularity, *AD* is the ad spending on that brand (not vehicle), *IN* is the incentive spending and *DE* is the number of dealerships in the U.S. If a car model spans several subgroups, only vehicles corresponding to that particular subgroup are considered (not total model sales). The incomplete data resulted in a somewhat inaccurate model (cf. the low r^2). All of these variables (*PR*, *OV*, *XM*, etc.), *x*, are relative, which means that they are normalized relative to the average, *avg*, for all cars in the particular subgroup in question, i.e. x/avg -1.

It is seen that if there is only one competitor the market share will be one (each of the normalized variables will be zero), and if there are N competitors with identical products, identical pricing and identical marketing efforts (no differentiation) each one claims an equal share of the market. The negative coefficient for price (a_{PR}) indicates that cheaper cars, everything else being equal, will gain more market share. As a first approximation this coefficient becomes the elasticity of demand within the subgroup in the utilityscape. Based on the coefficients the middle age group is the least price sensitive—in agreement with the observation that they also dominate some of the subgroups with the highest average car prices. The number of dealerships is important, in particular for the older buyers, while the younger buyers may be more willing to travel longer distances to purchase a new vehicle. Older buyers are also more likely than younger or middle aged buyers to buy models that have been in the market for some time. The data also show that ads are most important in attracting the younger buyers. The next chapter illustrates how these results can be used to estimate the sales of a car model new to the market.

---

[112] The data was compiled from vehicle sales literature/vehicle specs as published/publicized by manufacturers and/or dealers as well as data obtained from the following sources: Power Information Network/J. D. Power and Associates; the *Standard Catalog* publications by Krause Publications and *Ward's Motor Vehicle Facts and Figures* by Ward's Auto/Prism Business Media. The dataset also includes data reprinted with permission from *Advertising Age*, Copyright, Crain Communications Inc. 2006. On p. iv these organizations are acknowledged for their permission to use their data for this case study.

[113] One sigma uncertainties are: constant 0.01, T 0.01, P 0.023, F 0.01, S 0.01 and C 0.025, $r^2 = 0.87$.

[114] Effectively Figure 32 to Figure 34 are five dimensional: transport (T), pleasure (P), fun (F), social (S) and sales volume. It is a challenge to visualize that many dimensions on a two-dimensional piece of paper, and it may take a little effort getting familiar with the presentation. The figures consist of a T-P matrix, where each cell in the matrix is an S-F matrix, and the numbers inside that matrix reflect the sales. So increasing the S-value by one is the next cell to the right in one of the small (inner) matrices, but increasing the T-value by one means jumping from one cell in one of the small matrices to the same cell position in the next small matrix to the right. The figure could just as well have had F and S defining the outer matrix and T and P define the inner matrices, or some other combination. The representation is equivalent to a decision tree, where T has three or five outcomes (depending on whether there are 81 or 625 subgroups), and at the end of each T-outcome there are three or five P alternatives, at the end of which are the F alternatives and then the S alternatives, leading to the sales volume of each combination. Again here the sequence of T, P, F and S is irrelevant. The problem with the decision tree representation is that it takes up much more space and, even when trained, it is almost, impossible to visually jump from, say, one F value to the next F without having to search. A third alternative presentation would be a table with all the permutations of T, P, F and S values listed along with the corresponding sales. Again this presentation is hard to use effectively and takes up much more space.

[115] Uncertainties represent 1σ. Regression based on the subdivision of the utilityscape into 81 subgroups. The regressions are based on 1944 samples.

Chapter 13
The *smart fortwo*

In 1994, Mercedes-Benz and the Swatch Group established a joint venture focused on ultra small vehicles: MC Micro Compact Car SA, later *smart* (short for Swatch-Mercedes-ART),[116] and today it is a wholly owned subsidiary of DaimlerChrysler AG. By September 1997 the first *smart* car made its debut and in October 1998 it was launched in nine European countries. As of 2004 *smart* was sold in 40 countries with sales of approximately 125,000 vehicles per year. DaimlerChrysler considered introducing the brand in the U.S.; however, decided later to shelve those plans.[117]

The U.S. market has traditionally been dominated by large, and not particularly fuel efficient vehicles, so does a micro-car like the *smart* have any potential at all in the U.S.? In the 1950s and 1960s several European companies, including BMW Isetta, Bond, Messerschmitt, Reliant and Zundapp, sold small three- or four- wheeled vehicles in the U.S., but these cars vanished eventually from the market. In Europe the high gasoline prices, taxes, environmental concerns and narrow inner-city streets help maintain an interest for small vehicles, and a significant, growing interest exists in that segment there. So a success in Europe may not be a reliable indication of the market potential in the U.S.

The present case study looks at the opportunities for one of the *smart* models, the *smart fortwo* (Figure 36), a two-seat car with unique styling and a footprint about half that of a regular midsize sedan. The case study builds upon the understanding of the car market in the U.S. developed in the previous chapter (see Figure 37 for an overview).

The Value Net

In Europe the *smart* car is bought by customers from a broad range of demographic groups not following the conventional automotive segments. With that experience in mind, it is therefore best to consider a broad range of possible customers and value net configurations. Part of the value net surrounding the *smart* customer is illustrated in Figure 38.

Figure 36. The *smart fortwo* is so small it can be parked in "half a parking spot"

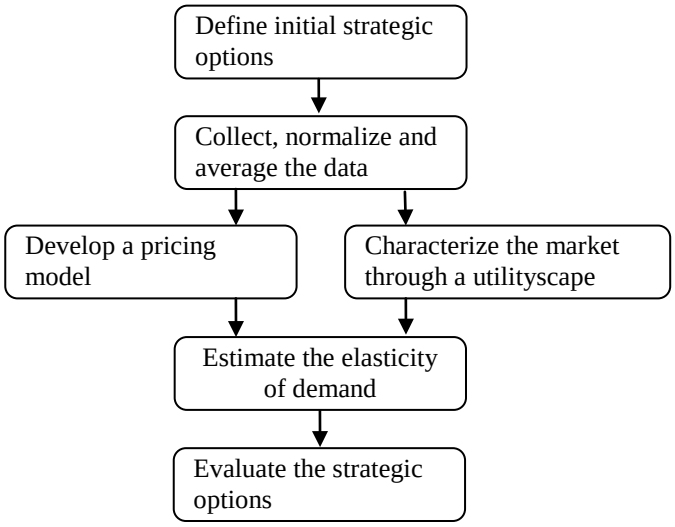


Figure 37. Overview of the method used. Some of the steps were discussed in the previous chapter.

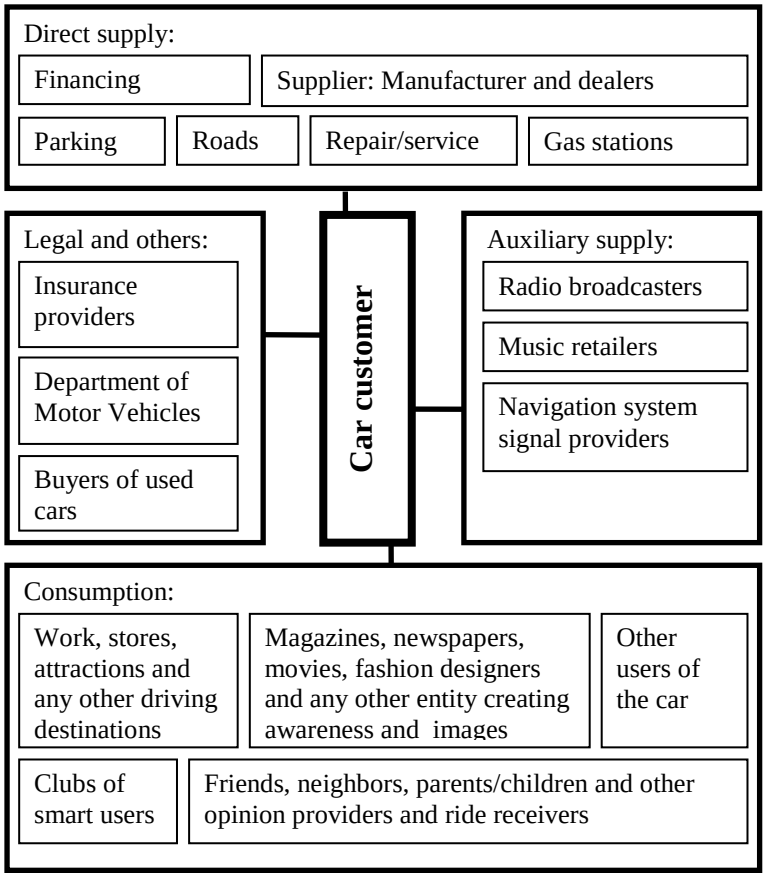


Figure 38. Part of the value net surrounding a *smart fortwo* car customer

The configuration of the value net will depend on who the customer is. Some of the prospective target audiences are:

- Young fashion-oriented people. Possibly wealthy high school and college students or recent graduates. Design, such as designer body panels, and some performance are important. These people often cannot afford large-ticket items. The main competition is from used vehicles of any kind. The music system is important. Tachometer and sport features are appreciated. Parents may worry about car safety. A low cost of ownership and a lower-than-average insurance premiums are pluses.
- Older people: many senior citizens avoid long trips; some only do a few errands within town. Others travel the country in an RV towing a small vehicle behind. Important features include: ease of operation (e.g., automatic transmission), comfort (e.g., a/c), maneuverability and ease of parking.
- Singles, a large and growing fraction of the U.S. population. While this car is ideally suited for their lifestyle, it may portray them as singles, and not all of them want to be portrayed that way.
- Environmentally conscious people: save energy, materials, and space on the congested roads. These customers may otherwise consider hybrid vehicles.
- Practical people looking for reliable transportation that is easy to operate and park. Infrequent need for refueling is a plus.
- Second car for commute and within-town errands for a family that already owns a family car. Second car for a person whose other car is not for all-occasion usage such as a $250k sports car.
- Urban residents who currently rely on public transportation.
- Rental companies. Most renters do not need to transport more than two people and most are "local" rentals, i.e., short trips and needs that are known prior to the rental.

We can evaluate the various potential target audiences and the value net configurations they require. That would be based on the demographic profile of existing buyers of transportation solutions such as new cars, used cars, motorbikes, and public transportation. The customers can be characterized based on their educational background, urban/rural residency profile, family size, age and other demographics. To keep this case study simple, only the age profile will be addressed, although the other parameters could be treated in a similar manner.

Initial Options

While some modifications can be made to the car, particularly in terms of options, the basic vehicle is already defined. Two related problems remain: (1) who should the target audience be/how should it be positioned? and (2) what is the best pricing strategy? There is a broad continuum of options; however, for the sake of simplicity only the following two discrete strategic options will be evaluated here:

Option 1. Low-volume social or fashion product, possible as a second or third car for urban use or for singles living in a city. A limited number (50) of dealers in selected urban areas will help

customers acquire cars that match their style. This option assumes a "brand image," comparable to a Toyota, and a price of $13,000.

Option 2. Higher-volume product: that is to position the car as a competitively priced vehicle for people with minimal transportation needs and a modest budget. That position will at the same time mean that the social score could be reduced somewhat, as "mass market" products have less social value than exclusive products. The cars will be sold through existing stores (2,500 in total), not dedicated car dealerships, throughout the country. In order to ensure that a broad range of customers can easily operate the vehicle let's assume it is offered with the option of an automatic transmission. This alternative assumes a "brand image", comparable to a Nissan and a price around $11,000.

Characteristics

When the *smart fortwo* is rated on the five dimensions the σ-scores relative to all other vehicles in the market are:

1. Transport: -1.67 σ to -1.59 σ, which indicates that this car is most appealing to people who want a small car.
2. Fun: -0.66 σ to -0.59 σ, which indicates that the *smart* is not intended for races or hard driving.
3. Pleasure: -0.07 σ to 0.51 σ indicating that the *smart* offers a fair amount of comfort, practicality and esthetics.
4. Social for option 1: 0.16 σ. The score slightly exceeds the "average car," it is pushed up by the *smart*'s fashion appeal and that it may be a cultural product, while the price (less then $20,000) does not in itself make it "prestigious." Social for option 2: 0.01 σ. The more mass-market positioning has drawn the social score down a little, compared to option 1.
5. Cost of ownership efficiency: 0.60 σ to 1.23 σ. The fuel efficiency and warranties help bring the car in line with some of the most economic cars in the market today.

Pricing

By inserting the characteristics for the *smart fortwo* into the price equation the following estimates are obtained for option 1: $11,275 to $12,450 (1σ uncertainty: $450). For option 2 the price drops to $10,725 to $12,075. The social standing score was based on *smart* being an import-brand fairly unknown to the U.S. public, however, if the social score is brought up to the level of a C-class Mercedes, then the price range increases to $19,725 to $22,650. That assumes that a competitive pricing strategy is selected.

Position in the Utilityscape

Independent of the strategic option the *smart fortwo* falls in the same subgroups of the utilityscape with 81 subgroups (Table 16); however, option 2 is getting close to the social subgroup 2.

Table 16. Subgroups that include the *smart fortwo* in the utilityscape

	81 subgroups (scale 1 to 3)	625 subgroups (scale 1 to 5)
Transport	1	1
Fun	1	1
Pleasure	2-3	2-5
Social	3	3 or 4*

* Strategic option 1: 4 and option 2: 3.

The lower social range has lower sales, and it may therefore not be desirable to drop too far in the social score. Table 17 includes competing car models in the 81-subgroup utilityscape and the sales of these cars are shown in Table 18. Considering that only about 25 percent of the new car purchases are made by the 16-35-year-old group, these subgroups present a somewhat stronger than average appeal to the younger buyers. In the 625-subgroup utilityscape there are no other vehicles in the subgroups where the *smart fortwo* falls (Figure 34).

Table 17. Competing cars in segments that the *smart fortwo* may enter in the utilityscape with 81 subgroups

T	F	P	S	Competing vehicles
1	1	2	3	Toyota Matrix 0.46, Honda Insight 0.28, Toyota Corolla 0.24, Toyota RAV4 0.11, Mazda Protégé 0.05, Volkswagen Golf 0.03, Honda Civic 0.02, Mitsubishi Lancer 0.01
1	1	3	3	Toyota Prius 1.00, Volkswagen Jetta 0.35, Volkswagen Beetle II 0.16, Toyota RAV4 0.04, Toyota Matrix 0.03, Volkswagen Golf 0.03, Toyota Camry 0.01

Notes: Value drivers: T—transport; F—fun; P—pleasure and S—social. Only cars with more than 1 percent of sales in the subgroup are shown. Cars like Ford Focus and Toyota Echo rank lower on the social scale than these subgroups.

Table 18. 2003 demand for vehicles (in units) in the two subgroups where the *smart fortwo* falls in the utilityscape with a total of 81 subgroups

T	F	P	S	Total	16-35	36-55	56+
1	1	2	3	110,984	31%	47%	22%
1	1	3	3	93,867	33%	45%	22%

Sales Estimates

The effect of introducing the *smart fortwo* can be estimated using the model for market share (Table 19) and assuming that the market remains the way it was in 2003 for which the utilityscape was calibrated, and that customers do not switch between sub-groups when a new product is introduced. In other words, using this approach assumes that the *smart fortwo* only cannibalizes sales from competitors within the subgroups in which it falls. Not every competing brand suffers equally, and by comparing results with and without the *smart*, it is seen that the cars that suffer the most are the Volkswagen models and Toyota Prius.

Sales of about 15,000 and 35,000 units are estimated for option 1 and 2 respectively. For comparison, the 2003 U.S. sales of the Ford Thunderbird reached about 18,000 units and Toyota Echo about 26,000 units. These are “steady state” sales, which means that they are annual rates

"some time" after introduction, not first-year sales. Option 1 will result in a younger age profile of the customers than option 2. While this result is expected, based on the different positioning, it is good to have it confirmed by the model.

Table 19. Market size estimates for the two strategic options using the 81-subgroup utilityscape

	Option 1	Option 2
Estimated total sales	15,447	37,375
16-35 years (of total)	30%	23%
36-55 years (of total)	45%	45%
56 years and over (of total)	25%	31%

A higher price influences sales in three ways: it decreases the market power, it decreases the cost savings and it increases the social score as a higher price will make people in general regard the car as "more." Figure 39 shows the combined effect on the estimated sales volume for an in-between option (close to but not identical to strategic option 1).

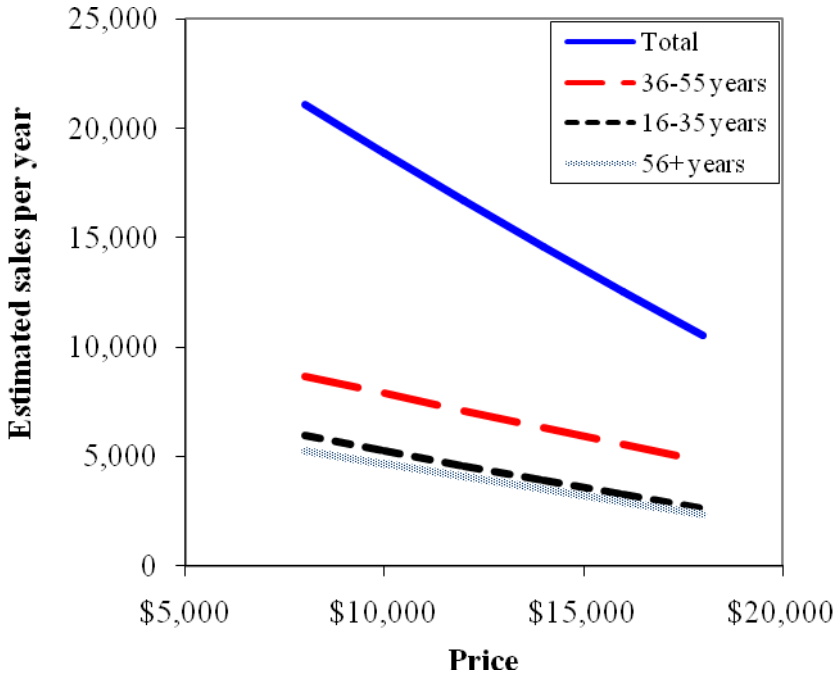


Figure 39. Estimated elasticity of demand for the *smart fortwo* in the U.S. for sales within the subgroups T1, F1, P2-3, S3. Assumptions: 100 dealers, $40 M/year brand ad budget, no dealer incentives. Estimates were calculated using the market share model based on the utilityscape with 81-subgroups.

Using the market share model on the 81-subgroup utilityscape assumed that the *smart fortwo* was a direct competitor to the cars in the subgroups in which it falls. That can be questioned because in terms of transportation it is smaller than any other vehicle in the market, and when it is plotted in the utilityscape with 625 subgroups it falls in three empty cells. It is not uncommon for an innovative product to extend the current utilityscape, and the question of how many customers

are likely to shift into these subgroups is therefore of general importance. We can use a market demand model to answer this question.[118] Table 20 shows the results of the model for the *smart fortwo*. Without a competitor in these subgroups the entire sales volume is assigned to the *smart fortwo;* however, had a competitor moved into the same subgroups, the market share model could have been used to estimate which fraction of the calculated sales would go to the *smart fortwo*.

There is a significant uncertainty associated with these numbers. For option 1 the total varied from about 8,000 to about 25,000 depending on how the model is constructed and optimized. However, for both options the estimates seem to agree globally with the estimates using the market share model on the utilityscape with 81 subgroups (Table 19). While in theory it may not matter which of the two methods is employed, the uncertainty on the market share model is in general much smaller and therefore preferable.

Table 20. Market size estimates for the two strategic options using the 625-subgroup utilityscape

	Option 1	**Option 2**
Estimated total sales	15,094	32,098

Evaluating the Options

The general aspects of the two strategic options are summarized in Table 21.

Table 21. Summary of the two strategic options discussed

	Option 1: cultural product	**Option 2: broader appeal**
Assumptions		
Price	$13,000	$11,000
Retail	50 dealerships	2500 stores
Brand image	high	medium high
Ad budget[119]	$50 million	$150 million
Incentives	$0 per car	$500 per car
Market estimates		
Sales	15,000 cars/year	35,000 cars/year
Market share	0.09%	0.21%
Target audience	Younger buyers, probably >50% females	Non-affluent customers of all ages
Strategic advantages	There will only be one "real" *smart*—that becomes very hard to copy by competitors	Could in the long-term be developed into high volume?
Strategic disadvantages	Price sensitive customers. The fashion may change faster than the vehicle, leaving it as an "outdated" style. May require large ad budget	Hard to really achieve the economy of scale needed for this model. Hard competition. Harder to differentiate than option 1

Option 1: Premium Product

This option builds on the *smart fortwo*'s strength in the pleasure dimension: exciting design, ease of operation and comfort. The estimates above indicate that there may be a market of about 15,000 units per year with the *smart* positioned this way. It may be possible to create a strong brand that talks to the customers emotionally and helps them define themselves in their social systems. In that case the *smart* will gain additional strength relative to the other competing vehicles and may be able to achieve even higher sales. The younger buyers are much more price

sensitive than the middle-age group buyers, so if the target audience is the younger people, then the price may have to be kept near the competitive prices calculated. Fortunately, a close proximity of a dealer is less critical for the younger group, but ads will be important.

Option 2: Low-Priced Transportation

While the *smart fortwo* will not be the cheapest vehicle in the market, it may offer a broader appeal than allowed for in option 1. One challenge of this option is to keep maintaining the image, because if the brand image slides, the vehicle moves down into a region of the utilityscape with lower sales. Brands selling in smaller quantities are often found in dealerships combining multiple brands, thereby allowing them to achieve combined sales in the order of 500-2000 vehicles per year (brand averages). That can be a challenge to achieve if the *smart* is sold on its own, and may require alternative channels of distribution different from the conventional. Such channels may include retailers not focused on vehicles.

Conclusions

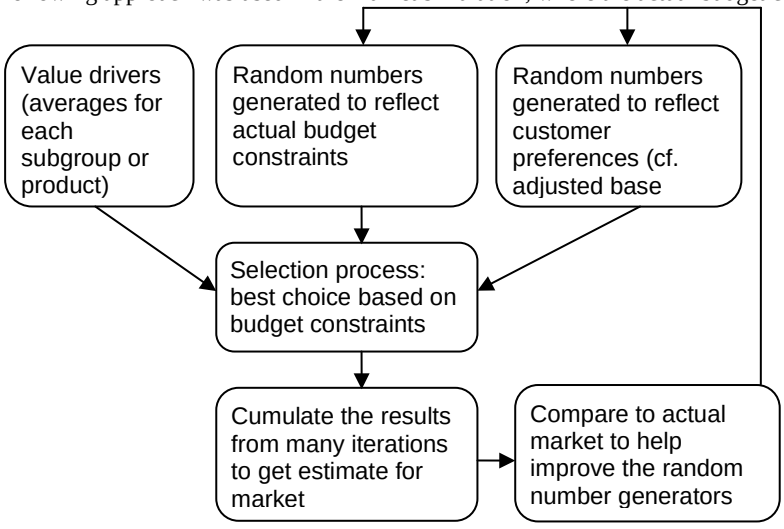
Without getting into the cost structure and the long-term potential that can be achieved by adding other *smart* models to the portfolio, the promise of the two options cannot be determined. However, looking at it from a volume and market share perspective, option 1 may be a good starting point, and possibly even a first step on the way to option 2. However, due to the potential conflict between specialized value-added resellers and mass-market channels, the transition from one option to the other may pose challenges unless carefully planned for in advance. The results here are for a "mature" situation; however, based on the time it took for brands like Lexus and Acura to achieve steady state we can expect this to take two to three years. It is reasonable to expect other products being introduced into this market space, either other *smart* models or vehicles made by competing carmakers, and the potential impact such product introductions may exert on the *smart fortwo* can be estimated using the market share model derived above.

---

[116] Tony Lewin, 2004, *smart thinking…. The little car that made it big*, Motorbooks International, 256 p. and Paul Guinness, 2005, The smart story, Haynes Publishing, 160 p.

[117] Diana T. Kurylko, 2005, It's Official: Smart's a no-go in the U.S., *Automotive News*, no. 6141, p. 3, 4 April 2005.

[118] The following approach was used in the market simulation, where the actual budget constraints are shown in footnote 109:



[119] High considering an industry average of about 3 percent of revenues going to brand ads.

Chapter 14
Discussion

For years the development of most products has benefited from structured knowledge and mathematical modeling to reduce the upfront risk during R&D and knowledge embedded in manufacturing processes to reduce the subsequent marginal manufacturing cost. Although business operations are more complex, we are starting to see a similar trend toward utilizing knowledge to manage value, risk, market power and cost. The framework of the present book will contribute to that trend.

The profit-loss equation reflects, like the fairytales, a simplistic view of the world where anything is either good (value, market power) or bad (Risk and Cost). This view goes back to southern Asia 4-5,000 BC, or even further back. Often we need more nuances than binary black and white. Imagine an organization where a boss must classify every employee as either good or bad. In reality, each employee will do something that may be beneficial for the organization and something that may not be so beneficial for the organization—and we often don't know until afterward where on the scale from bad to good a given act falls.

So in a world of grayscales and colors, rather than pure black and white, how can we analyze profit opportunities? The concept of key variables achieves that by focusing on the variables essential to influencing sales and profits without classifying these variables as either good or bad and letting every variable achieve a range of values reflecting how effective the product solution is in each key area. One single variable can even achieve values that go from being a liability at one end of the scale to being a benefit at the other end of the scale.[120] Or what is seen as a benefit to one person may be seen as a handicap by another. Money was invented as a tangible embodiment of a pure "good." But even that does not have the same value to everybody and the value will change over time (inflation or deflation).

All key variables undergo inflation or deflation over time, and the concept of utilityscapes deal well with that in that the axis are relative, meaning that they go from "low" to "high", but the definition of what "low" is and what "high" is changes over time. In that way the utilityscape tends to remain fairly constant even as the general expectations change over time. It is very unusual for a new product to add a new key variable to the utilityscape, most major innovations, only achieve going beyond the previous limit to what was achievable in one dimension or another. From the perspective of analyzing the business opportunities for new products, it is therefore very important to understand the market dynamics. How will customers react to a change in one key variable or anther?

There is an elasticity of demand associated with each key variable and by understanding and quantifying those we can come a long way in estimating what will happen, not only to the demand for new products but also to the demand for existing products if the system is exposed to external changes. Creating value is not the only goal of humans—their goal is to find a balance between value, risk and market power according to their personalities and personal desires. People tend to experiment throughout their life, changing the balance between the different key variables. Society goes in cycles, again providing some sort of collective experimentation.

[120] Kenneth R. MacCrimmon & Maseo Toda, 1969, The Experimental Determination of Indifference Curves, *Review of Economic Studies*, vol. 36, no. 4, pp. 433-451, Oct. 1969.

Chapter 15
Summary

This book describes a framework for how to analyze profit opportunities in a systematic manner (Figure 40). Each of the main steps is described in this summary. Not every author uses all terms the same way, and some of the terms listed here deviates from some of the definitions used elsewhere.

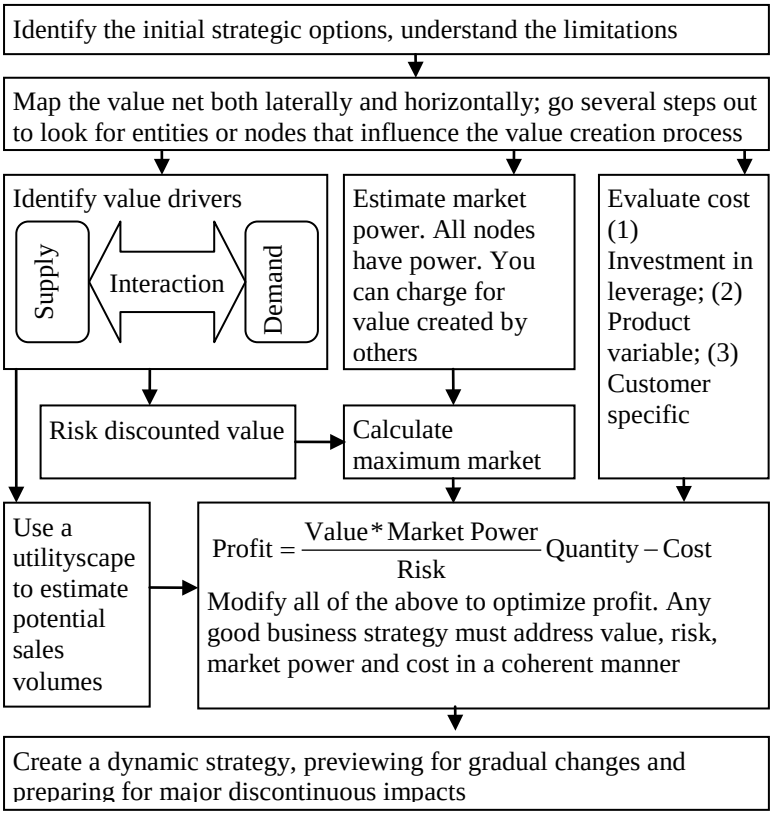


Figure 40. Summary of the method used

The Value Net. A value net is a system constituting of multiple nodes that through their interactions support, influence or hamper the formation of value.[121] The interactions can either be direct as a supplier or customer or indirect as an opinion maker or supplier of complementary products. See p. 5.

Node. A person or other entity involved in forming ties in the value net.[122] The nodes in the value net are linked through the joint creation of key variables. See p. 5.

Dynamics. The dynamics of the value net is in particular driven by trade and social networks, and changes are in particular caused by the establishment of sites that facilitate interactions and/or trade, from shopping malls to social network sites on the Internet.

Key Variables. The key variables describe the factors most important to the customer when they take a purchase decision. There are value variables and constraint variables. A value variable will typically have an optimal value to any given customer (e.g. desired performance characteristics) while a constraint variable typically represents a limit imposed by any given customer (e.g. maximum acceptable price reflecting a budget constraint). Some of the main groups of key variables are:

Value. A value driver is an identifiable key variable that influences the value to the customer.[123] A value driver is created when a customer has a need ***and*** a product provides a solution to that need. A customer need is a basic objective he or she wants accomplished, e.g., a jacket may have value drivers like keeping warm and delivering a social fashion statement. Most products have only a few value drivers, one of them typically being the customer's need to reduce the cost. We can often learn how much *value* is worth to customers by looking at savings or what customers today pay to have the same basic needs satisfied in other ways. Evidently, the amount of value a customer receives from a product or service will limit how much he or she is willing to pay. See p. 19.

Risk. As an investor discounts a risky stock, a customer will discount a risky product—the larger the *risk*, the less the customer will pay. Therefore, a car that breaks down frequently will command a lower price in the marketplace than a reliable car. Consequently, the value must be discounted with the risk to the customer in determining market price. The amount of discount can be estimated based on the price premium commanded by similar products that customers consider having more quality, higher consumer ratings and better warranties. So if you offer a warranty or a money-back guarantee, how much is that worth in terms of a higher selling price? And does it bring the product within the acceptable limits imposed by the customer? See p. 34.

Market Power. Market power is the relative ability of each of two nodes to retain value when they engage in a market transaction with each other.[124] See p. 36. The risk discounted value may be how much a customer will pay had there been no competition; there usually are competing offerings that reduce the market power to the seller because the buyer has alternatives. Market power reflects your ability to appropriate the value created—even value created by customers and suppliers. Gaining monopolistic power from dominating the market, owning patent rights or controlling a standard all give market power. The more competition, the lower the market power, and in the extreme case of a commodity market where suppliers enter or exit the market until the price is almost equal to cost and profits almost zero, the market power is the main factor dictating price. Market power is influenced by marketing efforts and channels availability. If the customer cannot find your product, then an attractive price will not help. Customers put limits to how extensive a search they will perform, so your product needs to be within those limits in order to have a chance of being sold.

Cost to the Buyer. We all put limits to how much we are willing to pay, so is the product priced with in limits imposed by a given customer? See section on Price below.

Dynamics. If the needs reflected in the key variables do not meet the customers' expectations sales drop. Price elasticity of demand shows the effect of different pricing, while value driver elasticity of demand shows the effect of different being off from the customers' expectations in terms of one value driver or another. See p. 69.

Utilityscapes and Constraint-scapes. A utilityscape is a multi-dimensional space where each dimension is defined by a key variable. Products and customers can be plotted in this space as a way of characterizing the market. Figure 41. For example, if it is a sports car the buyers are likely to occupy the high-fun, low-transportation part of the utilityscape, while truck drivers will occupy the opposite corner. Product scores for each value driver define where in the utilityscape they plot. Customers select products based on proximity to their objectives. Differences in customer objectives create areas of high and areas of low base demand. By looking at historical sales we can get an idea of how many customers may settle in different parts of the utilityscape. See p. 25.

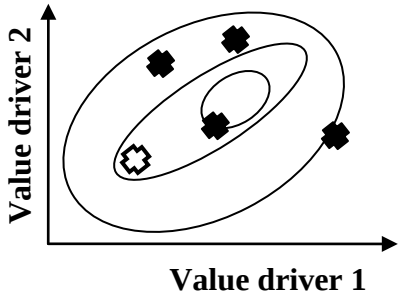


Figure 41. Utilityscape with contour lines for customer demand and X-marks for product locations

Segments. A segment is an area of limited extend within a utilityscape.[125] Segmentation is achieved by dividing the utilityscape into territories defined by ranges for each key variable. So within a given segment all customers are similar in their ratings of the key variables. Looking at the demand for different combinations of key variable combinations we can estimate the market size for a products with that combination.

Segment market share.[126] A segment in the utilityscape may be occupied by more than one product. The market share achieved by one of N products within that segment can be approximated as:

$$Market\ Share = \frac{Market\ Share\ Drivers}{N}$$

The See p. 98 and 82. Based on the segment market share we can estimate the sales volume for a product in that segment:

$$Volume = Segment\ Demand * Segment\ Market\ Share$$

Market Share Drivers include variables such as ad spending, time in market, brand recognition, and number of distribution channels—all relative to the other products in that segment. The car case study (Chapters 12-13) goes further into this.

Dynamics. For a new product the utilityscape will rapidly change as the customer discovers this new product space. A first product in a segment may pull customers from near the previous frontier or customers previously outside the utilityscape. Not every segment in the utilityscape is likely to have customers, and the dynamics of the key variables can help us predict which trade-offs the customers likely will accept and how much a mismatch will hurt sales.

Price. So by looking at the three basic factors—value to the customer, risk to the customer and market power – we can evaluate the price potential for a product. For a variety of reasons,

companies may lower the price, and the factor *h* reflects that pricing decision. The price is given by the following conceptual equation:

$$\text{Price} = \frac{Value}{Risk} * Market\ Power * h$$

See p. 39.

Pricing decision factor (*h*). The (theoretical) ratio between the price and what could in theory have been charged. See p. 39.

$$\text{h} = \frac{\text{Actual selling price}}{\text{Maximum theoretical price}}$$

Cost. In the profit-loss equation the cost is the monetary expenses associated with the delivery of a good or service in question. The costs have four components: product-specific fixed and variable cost, and customer-specific fixed and variable cost.[127] See p. 34.

Leverage. The utilization of knowledge to increase value while reducing the consumption of scarce resources. This normally is a result of prior investments small compared to the outcome.[128] See p. 34.

Profit-loss. We now have all what is needed to estimate the profit or loss (Figure 42).

$$Profit = Price * Volume - Cost$$

For multi-period cash flows we can the use corresponding Net Present Value calculations.

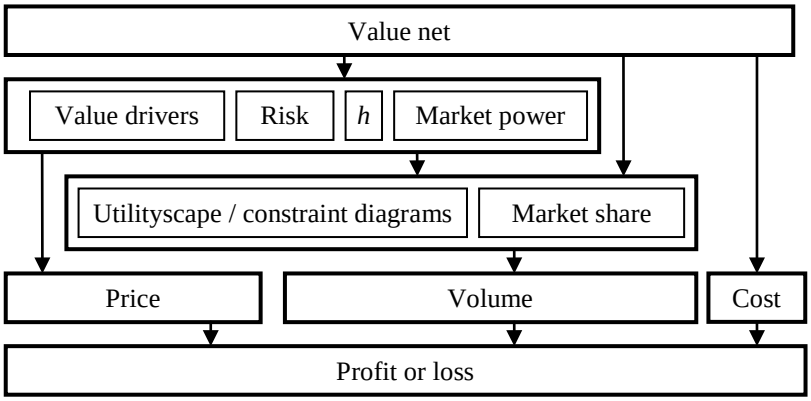


Figure 42. Key variables driving profit or loss. *h* is the pricing decision factor

Innovation. Creating new solutions to value creation, risk management and market power acquisition challenges.[129] See p. 53

Enabling mindset. A comprehension of a technology or methodology that makes it feasible to use or manage the use of it as a tool for solving problems. This is the human counterpart to the enabling technology explained next. See p. 56.

Enabling technology. A technology that makes it feasible to manufacture certain products.[130]

Changes. Typically, over time, a product will face certain predictable changes (Table 22). Staying afloat in terms of profits requires an ongoing adaptation to the changing utilityscape by repositioning products, or introducing and withdrawing products. Sometimes the changes in the marketplace can, however, be fairly unpredictable, but there are a number of ways to address that. and Table 23 and Figure 43 shows how some of these

tools supplement each other in terms of addressing changes of different magnitudes and time-scales.

Table 22. Predictable changes to expect when product ages

Value net	• Complement suppliers increase in number • Vertical and/or lateral integration occurs sometimes
Value	• More value as customers learn to use product and integrate it into more value nets • Less value to the most reluctant customers—as customer base increases in size
Risk	• Reduction in risk as company and product become established
Market power	• Increase in market power if leadership position is secured • Decrease in market power as competition enters—both direct and indirect competition—and customers are being pulled away to new territory in ever-expanding utilityscapes
Cost	• Decrease in cost as time elapses—cf. learning curves

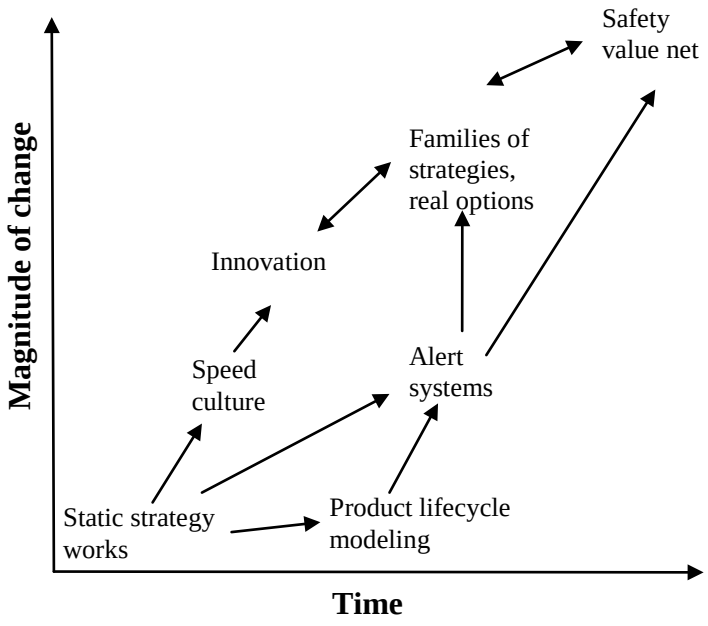


Figure 43. Summary of selected change survival tools

Table 23. Strategies for dealing with unpredictable changes

Value net	• Create an external safety value net, establishing links to external partners with capabilities that potentially could become useful in quickly creating new capabilities. See p. 60. • Use an internal value net (organizational structure) with autonomous teams working toward common goals. Distribute observation, thinking and decision making in the organization, reducing risk of reacting slowly to threats or opportunities or relying entirely on the luck of one team
Value	• Be innovative and foster a culture capable of adapting new technologies—quickly • Modularity allowing the repositioning of the aggregate product in one or more of the value driver dimensions without redesigning the entire product and manufacturing facility

Risk	• Look at the risk reduction effect of projects/investments considered
Market power	• External pressure helps keeping company competitive
Cost	• Accept higher cost in return for a higher chance of long-term survival
Strategy	• Strategic focus keeping the value net manageable, but within that pursuing multiple parallel efforts reducing the tactical risk

Profit Strategy

Profits require a reasonable balance between each of the four key variables in the profit-loss equation (value, risk, market power and cost), for example, we cannot succeed having a strategy that relies on value, but has no market power, has infinite high risk to the customer and has absolutely no cost advantages.

Most businesses tend to start out with a strategy that relies on one or two of the four key variables, but as the product or service matures, businesses must gradually include all of these variables because key variables not actively managed by us offers the competition an opportunity to take over and succeed. The basic profit-loss equation gives us a tool we can use to analyze strategies and investment options leading to faster and more successful development of new markets based on a good balance between all the dimensions discussed.

Any value net will feel the strain if the differences are too large from one node to the next, or if the changes over time occur too rapidly. That effectively determines how fast a company can grow and develop new solutions, and for the society at large it limits the evolution of history. For many products the development of an enabling mindset among the potential users takes more time than the development of the enabling technology, and growth is therefore not limited by the technology per se.[131]

When a company redefines a market and leaves the competitors far behind, what did they change? It could be basically anything: the value net configuration, a new product or technology providing new value drivers or at least occupying new areas of an existing utilityscape, risk, market power and/or cost structure. The corollary is that when you look for competitive opportunities you can explore any of the factors in the profit-loss equation. However, most traditional businesses rely extensively on only one or two of the variables:

Value. Some companies specialize in creating value, e.g., through innovation and new product development. Some of these companies unfortunately fail to follow up in these areas:[132]

- Generating incremental product improvements.
- Developing the manufacturing processes required to keep the cost down.
- Developing sufficient market power to profit from the value created.

When companies with a fast follower strategy focus in these areas, they many times emerge as market leaders.

Risk. Financial Engineering has been used as a tool by several companies to develop a business strategy revolving around managing risk in innovative ways.[133]

Market power. Pharmaceutical companies target not only value creation but also their ability to appropriate value. These companies often explore market power based on patents and trademarked brand names.

Cost. Many companies undergo major cost-cutting exercises, making efficiency the pillar in the corporate strategy. For example, several trucking companies and railroad companies have developed successful business strategies based on operations models while still paying attention to what the customers seek. Many of the East Asian manufacturers successfully contain costs through efficient manufacturing operations.

Multi-string strategies. When the profit-loss equation indicates that we must pay attention to each of these variables in order to succeed, why do so many companies then focus in just one area? First, different markets or types of products benefit particularly from the strength in one area or another, so in an emerging high-tech market, for example, value creation dominates to a point that inefficiencies in manufacturing do not threaten the business. Second, there are cultural challenges. Each variable requires a given enabling mindset to be successful, so if a company employs the ideal people for succeeding in one area, it may take a good deal of training to achieve optimal performance in other areas. But then what is optimal? That all depends on how dynamic the market is.

---

[121] See for example Cinzia Parolini, 1999, *The Value Net, A Tool for Competitive Strategy*, John Wiley Books, Chichester, 239 p.

[122] Cinzia Parolini, 1999, *The Value Net, A Tool for Competitive Strategy* (John Wiley Books, Chichester, 239 p.), uses an activity based definition of nodes, p. 81.

[123] For an alternate definition of the term see: Mark C. Scott, 1998, *Value Drivers, The Manager's Guide to Driving Corporate Value Creation*, John Wiley & Sons, Ltd., Chichester, 261 p.

[124] This definition is consistent with the definition in David W. Pearce & Robert Shaw (eds.), 1997, *The MIT Dictionary of Modern Economics*, 4th ed, The MIT Press, Cambridge, MA 474 p.

[125] This a different wording of the conventional definition, see for example, p. 69 in Philip Kotler, 1988, *Marketing Management, Analysis, Planning Implementation, and Control*, 6th ed., Prentice Hall, Englewood Cliffs, NJ, 777 p.

[126] This is the product and segment level equivalent of the conventional company/brand and market level definition.

[127] For the conventional definition see p. 20 in Charles T. Holmgreen & George Foster, 1987, *Cost Accounting, A Managerial Emphasis*, 6th ed., Prentice-Hall, Inc., Englewood Cliffs, NJ, 980 p.

[128] This usage of the term is consistent with the definition in *Webster's New Universal Unabridged Dictionary*, 1996, Barnes and Noble Books, New York, 2230 p., Rafael Ramírez & Johan Wallin, 2000, *Prime Movers, Define Your Buiness or Have Someone Define it Against You*, John Willey & Sons, Ltd., Chichester, 331 p. and (technological) leverage in Tim Dickson & George Bickerstaffe (eds.), 1997, Financial Times: *The complete MBA companion, The Latest in Managemement Thinking from the Worlds's Leading Business Schools*, Pitman Publishing, Lanham, MD, 678 p.

[129] For a discussion of this term see for example, p. 10-11 in Nino S. Levy, 1998, *Managing High Technology and Innovation*, Prentice Hall, Upper Saddle River, NJ, 274 p.

[130] For an example see: Henry Baltes (ed.), 2004, Enabling Technology for MEMS and nanodevices, Wiley, Weinheim, 427 p.

[131] C. M. Christensen came to a similar conclusion, although from a different starting point: Clayton M. Christensen, 2000, *The Innovator's Dilemma*, HarperBusiness, 286 p.

[132] Joseph G. Morone, 1993, *Winning in high-tech markets: the role of general management; how Motorola, Corning, and General Electric have built global leadership through technology*, Harvard Business School Press, Boston, MA, 292 p.

[133] Peter Tufano, 1996, How Financial Engineering Can Advance Corporate Strategy, pp. 123-152 in *Harvard Business Review on Advances in Strategy*, 2002, Harvard Business School Press, Cambridge, MA, 243 p. (Originally published in *Harvard Business Review*, vol. 74, no. 1, pp. 136-145, Jan. – Feb. 1996).

Appendix 1
The Profit-Loss Equation

The profit-loss equation can be derived in a variety of ways from existing theory. Below follows one such deviation. In a market with perfect competition, the price approaches cost. The price tends to be lower when there are more companies in the industry and when the elasticity of demand is higher.[134] In general, the elasticity of demand is less for products with a high level of necessity and for products without any close substitutes, giving companies a higher level of monopolistic power. Numerous authors have studied either monopolistic power or market power in relationship to prices, markup or profit in various markets.[135] Marchetti found a negative correlation between markups and competition.[136] While many authors have been working in this area, the findings by Waterson[137] and Barla[138] are used here to describe the aggregate industry profit, $\pi_{industry}$, assuming a Cournot oligopoly:

$$\frac{\pi_{industry}}{IR} = \frac{IC_f}{\eta} + H \qquad (27\text{-}1)$$

where IC_f is the fixed cost for the industry, IR is the aggregate industry revenue, η is the elasticity of demand and H (short for Herfindahl)[139] is a measure for the firm size inequality among companies in the industry:

$$H = \sum_i MS_i^2 \qquad (27\text{-}2)$$

where MS_i is each of the i firm's market share, or share of capacity, so a competitive market has a low H.[140] Rather than examining the entire market, we can use the approach to investigate an average company. If the total quantity sold in the market is Q, the average price is $P = IR/Q$, the average profit for one unit is $\pi = \pi_{industry}/Q$ and the average fixed cost to price ratio is C_f / P = IC_f / IR. We now have:

$$\frac{\pi}{P} + \frac{C_f}{P} = \frac{H}{\eta} \qquad (27\text{-}3)$$

or

$$\pi = P * (H/\eta) - C_f \qquad (27\text{-}4)$$

This indicates that the profit margin (π/P) is proportional to H/η at a given cost.

Many authors have suggested a relationship between perceived customer value and price,[141] and it is, for example, often considered the case in financial markets where the stock price can be viewed as the present value of the future profits generated by the company. For most goods, value is something we receive over a period of time, subsequent to the moment the purchase decision is taken. In finance we discount value received in the future to the present value, by taking the risk into account. If it had been a financial product delivering a certain fixed income at regular intervals, then the quantification of this value would be simple because it is defined in a

unit of currency. The present value, *PV*, of a sequence of future value deliveries, V_t, can be expressed as:[142]

$$PV = \sum_t \frac{V_t}{(1+r_t)^t} \qquad (27\text{-}5)$$

where r_t is a discount factor. In models like the Capital Asset Pricing Model, we relate this discount factor to the risk associated with future cash flows:[143]

$$r = r_f + \beta\,(r_m - r_f) \qquad (27\text{-}6)$$

where the discount factor, *r*, is expressed as a function of the expected return on a risk free asset, r_f, the expected rate of return on the market portfolio, r_m, and the slope in a regression of the return on the stock relative to the return on the market portfolio, β. The difference (r_m-r_f) is the risk premium for the stock. The following discussion will focus on the risk part of r; the risk-free interest is a topic of its own that will not be covered here. Dhar and Glazer extended the risk concept of investment to estimating value of customers by treating the customers as an investment portfolio.[144] While we lack a similar simple expression for a product, all products are associated with a certain risk level, and it is reasonable to assume that the market price is influenced by risk in a similar fashion. Therefore, if *r* is a discount factor reflecting the general risk of an asset, we can express a risk-adjusted value to the consumer, V_r, in the following manner:

$$V_r = \sum_t \frac{V_t}{(1+r_t)^t} \qquad (27\text{-}7)$$

or for a single period:

$$V_r = \left(\frac{V}{1+r}\right) \qquad (27\text{-}8)$$

While conventional net present value calculations will not discount values realized at time = 0, we can expect any customer purchase to be discounted because even if the product is purchased and instantaneously consumed there will be some uncertainty. Under market conditions favorable to the seller, V_r will represent the upper limit to the price that the customer may be willing to pay, i.e.,

$$P_{max} = V_r \qquad (27\text{-}9)$$

By combining (4), (8) and (9) we have:

$$\pi_{max} = (H/\eta)\left(\frac{V}{1+r}\right) - C_f \qquad (27\text{-}10)$$

The previous equations emphasize several aspects of creating profits, namely create value to the customer (*V*), reduce the risk (*1+r or R*), gain market power (H/η or *MP*) and keep cost (*C*) down. By using the alternate symbols we have for a single period the following conceptual equation:

$$\pi_{max} = MP \cdot \left(\frac{V}{R}\right) - C \qquad (27\text{-}11)$$

This equation assumes that the seller is charging a price that is as high as the buyer is willing to pay. That is not necessarily the case; in fact, a company may set the price purposely low to gain market share, so we may define a ratio between the actual price and the maximum price that could be charged:

$$h = \frac{Actual\ Price}{Maximum\ Price} \qquad (27\text{-}12)$$

The ratio, *h*, is here called the pricing decision factor.

Parolini suggests a similar division of the value into two parts:[145] (1) the net value to the customer is described as the difference between the gross value to the customer and the purchase price and (2) the net value to the supplier(s) is described as the difference between the price and the cost. The latter corresponds to the profit discussed here after taking the *h* factor into account. By combining equations 27-11 and 27-12 we have a simplified profit-loss equation for the sale of one unit, with all transactions within one time period:

$$\pi = h \cdot MP \frac{V}{R} - C \qquad (27\text{-}13)$$

The first term of this equation is the market price, P, so the corresponding simplified price equation is:

$$P = h \cdot MP \frac{V}{R} \qquad (27\text{-}14)$$

The second term is the cost. The cost can be viewed in two ways:

1. It can be expressed as the purchase price of each component going into what is being sold. In that way it will be related back to another set of market power, pricing decision factor, value and risk factor equations—now describing the seller and the seller's suppliers, including employees and tax authorities.
2. It can be broken down the way accountants do it, e.g., separating fixed and variable cost. As this equation concerns the transaction of a single item, the fixed cost is the total fixed cost divided by the total number of units sold.

The profit-loss equation contains three types of variables:

1. Variables associated with the market such as power of the buyers and suppliers (*MP*). This is traditionally a zero-sum game: there is only a finite purchase power in the market at a given moment, and the balance of market power determines how much each party receives from a deal.
2. Variables associated with what the customer receives (*V* and *R*). This is an open-ended game where there are no theoretical limitations to what can be created.

3. Variables associated with the resources required (*C*). Cost is limited by the availability of scarce resources (material, labor, investment in R&D, investment in manufacturing facilities, etc.)

The above is what could be considered a conventional deduction of the profit-loss equation. Besides that the validity is supported by successful applications in many other fields.[146] As a side note at the end of this chapter a parallel to a very different area is drawn. Folklore fairytales from a variety of cultures and continents display some commonalities in their structure. According to Greimas/Tatar, a traditional folklore fairytale contains the following basic characters:[147]

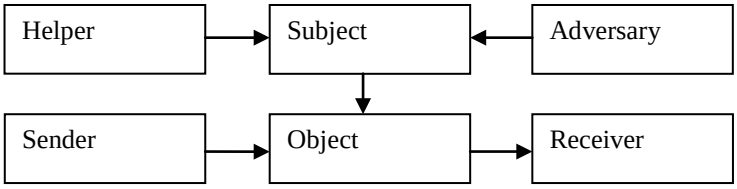


Figure 44. Traditional role pattern in fairytales (modified after Greimas/Tatar)

An example of a fairytale could be: a horrible dragon (Adversary) captures the king's (Sender) daughter (the princess, Object). By the help of a fairy (Helper) a foreign prince (Subject) frees the princess, he (Receiver) marries her and they live happily ever after. Although the language of the fairytale is far from modern finance and economy, we can make some reasonable analogies as follows (Table 24):

Table 24. Comparison of fairytale and profit-loss equation variables

Fairytale	Equation	Explanations
Subject/hero	Value	The core of the story or market transaction
Adversary	Risk	What is threatening
Helper	Market power	External forces that can help you achieve your goals
Object	Market price	What is "changing hands" in the story
Sender	Cost	The sender (like the king) often sets the terms of the transactions, thereby dictating the cost
Receiver	Profit	What made the entire endeavor worth while for the recipient (often the person who is the hero)

Like the fairytales, which normally have multiple characters filling a single role, such as a group of helpers, most business operations woo a number of customers that form one group in the value net. So using the fairytale pattern with business terminology we get (Figure 45):

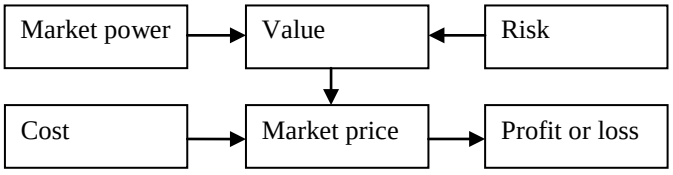


Figure 45. Business terms applied to the basic role pattern in folklore fairytales

The upper part of Figure 45 determines the price while the lower part dictates the profit. This is actually a good illustration of the profit-loss equation in its own right.

---

134 Jack Hirshleifer, 1984, *Price Theory and Applications*, 3rd edition, Prentice-Hall, Inc., Englewood Cliffs, NJ, 574 p.

135 For example: Philippe Barla, 1998, Firm Size Inequality and Market Power, working paper 9714, Université Laval, Québec; Russell Cooper & João Ejarque, 2001, Exhuming Q: Market Power vs. Capital Market Imperfections, *National Bureau of Economic Research Working Paper* no. W8182, March 2001 and Matthew D. Shapiro, 1987, Measuring Market Power in U.S. Industry, *Cowles Foundation Discussion Paper* no. 828, Cowles Foundation for Research in Economics at Yale University, 36 p.

136 Domenico Marchetti, 2002, Markups and the Business Cycle: Evidence from Italian Manufacturing Branches, *Open Economic Review*, January 2002.

137 Michael Waterson, 1984, *Economic Theory of the Industry*, Cambridge University Press, Cambridge, 243 p.

138 Philippe Barla, 1998, Firm Size Inequality and Market Power, working paper 9714, Université Laval, Québec.

139 Barla op. cit.

140 Barla op. cit.

141 Examples include E. Berndt, L. Bui, D. Reiley & G. Urban, 1994, The Roles of Marketing, Product Quality and Price Competition in the Growth and Consumption of the U.S. Anti-ulcer Drug Industry, *Sloan School of Management, MIT, working paper*, May 1994 and Robert J. Dolan & Herman Simon, 1996, *Power Pricing, How Managing Price Transforms the Bottom Line*, The Free Press, New York, 369 p.

142 R. A. Brealey & S. C. Myers, 1996, *Principles of Corporate Finance*, McGraw-Hill, New York, 998 p.

143 C. J. Campbell, H. B. Kazemi & P. Nanisetty, 1999, Time-Varying Risk and Return in the Bond Market: A Test of a New Equilibrium Pricing Model, *Review of Financial Studies*, vol. 12, no. 3, pp. 631-42; Aswath Damodaran, 2001, *The Dark Side of Valuation, Valuing Old Tech, New Tech, and New Economy companies*, Financial Times, Prentice Hall, London, 479 p.; J. Lintner, 1965, The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets, *Review of Economics and Statistics*, vol. 47, pp. 13-27 and W. F. Sharpe, 1964, Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk, *Journal of Finance*, vol. 19, pp. 425-442.

144 Ravi Dhar & Rashi Glazer, 2003, Hedging Customers, *Harvard Business Review*, vol. 81, no. 5, pp. 86-92, May 2003.

145 Cinzia Parolini, 1999, *The Value Net, A Tool for Competitive Strategy*, John Wiley & Sons, Ltd., Chichester, U.K., 239 p.

146 K. Tobias Winther & Cecilia B. Mazza, 2004, A Profit-Loss Equation Applicable to Business, Economy, Finance and *Sociology, Social Science Research Network*, http:// www.ssrn.com/, posted 11 Feb. 2004, http://ssrn.com/abstract= 499183

147 A.-J. Greimas, 1966, *Sémantique structurale: Recherche de méthode*, Larousse, Paris referred to in Maria Tatar, 2003, *The Hard Facts of the Grimms' Fairy Tales*, 2nd edition, Princeton University Press, Princeton, NJ, 325 p.

Index

Bold: main entry
Italic: figure

The Author and the Book

About the Author

Dr. K. Tobias Winther is the president of Agityne Corporation. He holds a Ph.D. from the University of Chicago, an MBA from Rensselaer Polytechnic Institute (RPI), and a science degree from Copenhagen University. He is the author of numerous articles in business, science and engineering publications and has given many talks in these fields. Among the positions he previously has held is Technology Development Director at the Center for Automation Technologies at RPI.

How Did this Book Originate?

Working at an economic development center in Upstate New York, I helped companies develop new products or new factory automation systems; however, many times the problems faced by these companies were not rooted in technology as much as in their understanding of the business side. While we would use modeling and simulation to reduce the risk of the engineering project, a similar approach was not used to reduce the risk on the business side. I then started Agityne Corp., a management consulting company, dedicated to using systematic and quantitative methods to support companies in their business decisions. The critical step is to be able to link company decisions to the future financial performance. Modeling and simulation in engineering build upon the laws of physics and chemistry combined with data. To do the same in business I created a framework based on theories in management, economics and finance, and I learned ways of collecting and structuring relevant data. This book was written to help managers better understand this framework.